THE IRON TRADE REVIEW

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High Prices for Finished Products

Buyers Have Much Difficulty in Placing Orders—Serious Shortage of Semi-Finished Material—Pig Iron is Active

THE old year is drawing to a close, with mills overwhelmed with orders, with the pig iron market extremely strong, and with general conditions highly satisfactory except that, as is usual in periods of intense activity, there is considerable trouble in making deliveries satisfactory to customers and some mills are having much difficulty in obtaining supplies of semi-finished materials. Tremendous demand for materials for export is still a prominent feature of the market, but the action of the railroads in declaring embargoes against materials for export has, to some extent, benefited the movement of iron and steel products for purely domestic use. It is estimated that the total requirements of European countries for shell steel now pending in the market will amount to the immense total of nearly 1,000,000 tons, most of which is for delivery during the last half of 1916. France alone is in the market for 40,000 tons of blooms. In addition to the foreign inquiries now pending, a number of shellmakers in this country are seeking protection on round tonnages of steel to cover contracts which are pending. Not many of the inquiries for shell steel for last half delivery have resulted in contracts with the mills, but it is expected that a heavy tonnage will be closed soon. Some mills will accept last half business of this character at 3c, mill.

Pig Iron

Holiday festivities and inventory taking have had almost no effect on the pig iron market and sales during the past week aggregate a large tonnage. In New York territory, they amounted to fully 30,000 tons. There was also much activity at Philadelphia. The Virginia Iron, Coal & Coke Co. now has taken 60,000 tons for last half delivery. The Virginia furnaces and some in the east are willing to sell for last half delivery, and at Chicago, one interest is willing to sell No. 2 foundry at $18.50 for delivery throughout 1916, but most sellers in the central west are extremely conservative about quoting for last half. The minimum Virginia prices are $17.50 for No. 2 foundry for first quarter or first half of next year and $18 for last half. Along the lakes, pig iron prices are still tending upward, and at Cleveland, $19, furnace, for No. 2 foundry is now the prevailing price for local delivery. In the south, prices are firm, with $15 to $15.50 as prevailing quotations for first half delivery.

Billets and Sheet Bars

Decided shortage in billets and sheet bars continues. One northern Ohio mill, which has not been able to operate on account of not having a supply of sheet bars, has offered as high as $45 per ton. It is almost impossible to obtain a supply at any price. Recent sales have been at $35.

Sheets and Tin Plate

Extremely strong demand for blue annealed sheets continues and prices range from 2.40c to 2.60c, Pittsburgh, for the limited tonnages that can be purchased. In some cases, for delivery during the first quarter of next year, 2.85c has been quoted. Tin plate prices have been advanced $3 per ton by a number of makers and further advances are expected.

Shapes and Bars

The usual quotation on standard shapes is now 2c, Pittsburgh, but as high as 2.25c, eastern Pennsylvania mill, is being quoted. On plates, 2.25c, Pittsburgh, is the minimum with eastern mills, but 2.50c, Pittsburgh, is the minimum at Cleveland, where as high as 3c has been paid in some cases. On bars, leading companies are said to have booked second quarter contracts at 1.80c, Pittsburgh, but buyers report that they have great difficulty in entering orders at any price below 3c.

Machinery

With the exception of Russia, which has placed large orders for machine tools, the buying of machinery for export is not so heavy, but the volume of business due to domestic demand is large. Steel companies, ship builders, railroads, automobile companies and oil companies are figuring prominently in the market.

THE OPEN HEARTH

Ore Dominates the Lakes

THE YEAR 1915 will be remembered as a remarkable one in the history of lake transportation. The early part of the year was distinctly disappointing, but the movement of ore was very active during most of the year and the excitement toward the close was most unusual. Easily the record for movement of ore could have been surpassed, had the early part of the season done its share. The most interesting feature of the year was the rapid chartering of vessel capacity late in November, which had an important influence on the buying of numerous vessels this month. The action of the largest shipper in suddenly tying up a very large vessel tonnage to move ore next year quickly brought to other shippers the realization of the importance of having vessels of their own and they appeared in the market to buy any vessels that were obtainable. The changing of the ownership of numerous vessels has brought about much closer holding of vessel property and shippers of ore today dominate the lake situation through vessel ownership as they never before did. Grain, coal and other kinds of freight are subordinated. Everything makes way for ore. The ore men have decided to take absolutely no chances that can possibly be avoided of not having sufficient vessel capacity to move their product.

Indications point strongly to next year making a new record in ore movement. It will also add as much as can be built to the vessel tonnage of the present fleet, although the cost of building a vessel is now about 70 per cent more than it was a year ago and this cost is likely to be still further increased.

With vessel builders, the reversal from almost complete idleness to intense activity was even more sudden than the improvement in the movement of ore and grain. As nearly all the ore moved was under contract at season rate, the profits of the ore movement were only moderate, but the high rates on grain at the close of the year added large amounts to the exchequer of many vessels. On the whole, the season has been one of fair profits to vessel owners and next year seems certain to be much more profitable.

How Two Years Ended

AT THE close of 1914, *The Iron Trade Review* said: "Cheerful sentiment dominates at the close of one of the most unsatisfactory years in the history of the iron trade. The lull in buying and the decreased activity of plants, which always characterize the holiday season except in years of great prosperity, are features of the present situation, but the feeling that early in the New Year there will be a decided improvement has been growing stronger and an effort is being made to obtain higher prices on finished products. On plates, shapes and bars, leading independent companies have announced that after today they will not accept specifications for any delivery at 1.05c, Pittsburgh, which has been the prevailing price for prompt delivery, but will insist upon a minimum of 1.10c for either prompt or first quarter. This action has been concurred in by the Carnegie Steel Co., and fair tonnage has been specified in order to get the lower price."

The reading of the above paragraph is enough to show how radically conditions have changed during the past year. There has been very little lull in buying during the present holiday season and workers in the plants who were able to enjoy Christmas at home were indeed fortunate. The story of the year will be thoroughly reviewed in our next issue.

For how long the present prosperity will continue, no one can make a safe prediction, but indications point strongly to great activity throughout the year. The war cannot be ended suddenly. Even a war of the minor importance of the Spanish-American conflict was not terminated until after a considerable period of discussion as to the terms of peace. When it is considered that many nations are vitally interested in the present war and that innumerable questions must be settled before the terms of peace are finally agreed upon, it is easy to imagine that many months will elapse after the signing of a peace protocol, before the final conditions of peace shall have been agreed upon. This will mean a long period of uncertainty and that will cause hesitation in business. In the meantime, however, our home industries may have gotten fully started, as they certainly are not now, on home business and this country will probably enjoy reasonable prosperity even while peace is being debated. There is no occasion for borrowing trouble, but much reason for looking forward hopefully and with a determination to prepare to meet the severe industrial competition which is certain to come at the conclusion of the war.

No Time for Socialistic Experiments

WITH increase in patriotic sentiment and the very proper advocacy of reasonable preparedness has come the renewal of the agitation in favor of a government armor plate plant and to this project are added numerous others, providing for government activities, including all sorts of munition plants as well as ship building yards. Much of the clamor comes from noisy politicians and this is not worthy of attention, but there are a great many well-meaning people who are lending their support to the

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advocacy of an unsound proposition. Among the most eminent of these is the Right Reverend Charles D. Williams, bishop of the Protestant Episcopal church of the diocese of Michigan, who has declared himself in favor of reasonable preparedness, but has also asserted, as he did in an eloquent speech before the Cleveland chamber of commerce last week, that all munitions should be manufactured in government plants for the reason that no man should be allowed to profit by meeting the demands of war for ammunition.

With all due respect for the great ability and high character of the bishop, we must say that we believe his position is illogical and unjust. Why put the makers of armor plate and munitions in one black class of men who, on account of their alleged greed to make money through the suffering of their fellowmen, must be put out of business, while all others who directly or indirectly profit are allowed to continue in so doing? If it were possible to trace the benefits of the increased exporting, during the past year, it would be found that many lines of business have enjoyed increased prosperity on account of the war. Exports of clothing, cotton, foodstuffs, medicines, surgical instruments, artificial arms and legs, automobiles, flying machines, machine tools, and many other supplies should be included. If it is wrong to make powder, or a gun, or steel, and for that reason the government should go into the manufacture of powder, guns and steel, why should not the government go into all other lines of activity represented by the demands of warfare? We believe it is absolutely impossible to draw a line against a few people and not against others, if justice is to prevail.

The time has come for thinking people of this country to take a decided stand against present alarming socialistic tendencies. One very excellent and impressive way of protesting would be for leading cities of the country through their commercial bodies to declare their opposition to the building of armor plate and munition plants and say that they do not wish such plants located within their borders. Are there any commercial bodies which will have the courage to do this?

The sixty-fourth congress will reconvene on Tuesday of next week. What little it did before the holidays was only preliminary. The country now wants to see it get down to real business and give its ablest efforts to solving the tremendous problems before it. It is sincerely hoped that the ability to handle the issues properly really exists, and that it will be exerted to the utmost. Politics ought to be as completely lacking as the hyphen.

Living Up to Contracts

THE question—Shall a contract be lived up to or repudiated? is one that will not down. It is old, but it comes up with ever-increasing insistence as the years roll by. *The Iron Trade Review* of Jan. 1, 1914, contained an editorial on this subject which was in part as follows:

"More honesty is what the iron trade needs in the New Year. If every buyer will make a resolution today to be true to his written agreements and then live up to that resolution, a great change for the better will result. If every consumer will take every ton of material that he has agreed to take this year, even if it drives him into bankruptcy, he may be poorer in material possession, but far richer in self-respect. The iron trade will be greatly strengthened and more entitled to the respect of the business world. One custom that is reprehensible weakens an entire system. One indefensible practice taints the whole trade. It is high time to cut it out.

"May 1914 bring a keener appreciation of the sacredness of every contract and courage strong enough to enable every man to do his part in enforcing the contract."

Many consumers were put to the test in 1914 because it was a year of depression, but in the last half of the present year, the sellers were tested. In both years, we believe that more parties to contracts fulfilled their agreements than in earlier years, owing to the increasing sentiment in favor of living up to contracts. But, of course, there were many cases in which obligations were disregarded. Indications are not lacking now that the agitation for better business methods is to be continued. One of the most recent pleas for justice and fair dealing was voiced in a rather novel way in *The Iron Trade Review* of Dec. 16, in which, on advertising page 6, the Inland Steel Co. set forth its idea on this subject, asking for comment.

The promulgator of this homily on contracts seems to have every right to suggest a more equitable arrangement, since during the past few months it has shouldered a loss of many thousands of dollars on one product, galvanized sheets, by observing its contracts made before the phenomenal and entirely unexpected rise in spelter. Some sheetmakers repudiated their obligations rather than face the tremendous losses involved in their execution.

As the result of the publication of the advertisement, a number of communications have been received from consumers as well as producers and all agree that a contract should be a contract and binding on both sides, but how to make it so is the problem which still faces the iron world. May the New Year help to solve it!

Prices Present and Past

Quotation on leading products December 29, average for November, 1915, average for September, 1915, and average for December, 1914. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices Dec. 29, 1915.	Aver. for Nov., 1915.	Average for Sept., 1915.	Aver. for Dec., 1914.
Bessemer pig iron, Pittsburgh..	$20.95	$17.45	$16.80	$14.70
Basic pig iron, Pittsburgh.....	19.45	16.70	15.65	13.45
No. 2 Fdy. pig iron, Pittsburgh	19.45	16.45	15.45	13.70
Northern No. 2 Fdy., Chgo....	18.50	17.12	13.80	13.00
Lake Superior Charcoal, Chgo..	19.25	17.50	15.95	15.75
Mall., Bess., Chgo.....	18.50	17.42	14.20	13.00
Southern No. 2, Birmingham...	14.50	13.50	11.50	9.50
Southern Ohio No. 2, Ironton..	18.00	16.25	14.50	12.63
Basic, eastern Pa.....	18.50	17.75	15.25	13.50
No. 2X Virginia furnace.....	17.25	15.50	12.75	12.50
No. 2X foundry, Philadelphia...	19.75	17.75	15.00	14.25
Ferro mang., Balti., (prompt)..	110.00	100.00	110.00	68.00
Bessemer billets, Pbgh.....	30.00	27.75	24.60	19.00
Bess. sheet bars, Pbgh.....	31.00	28.25	24.60	19.50
Op.-h'th sh. bars, Pbgh.....	31.00	28.50	25.80	19.50
Open-hearth billets, Pbgh.....	30.00	28.00	25.60	19.00
Steel bars, Chgo.....	1.99	1.79	1.54	1.20
Steel bars, Pittsburgh.....	1.80	1.625	1.34	1.10
Iron bars, Philadelphia.....	2.059	1.759	1.459	1.15
Iron bars, Cleveland, local del'y.	1.80	1.50	1.35	1.15

	Prices Dec. 29, 1915.	Aver. for Nov., 1915.	Average for Sept., 1915.	Aver. for Dec., 1914.
Iron bars, Chgo. mill.....	$1.75	$1.48	$1.31	$0.95
Beams, Chgo.	1.99	1.79	1.54	1.20
Beams, Pittsburgh	1.80	1.625	1.34	1.10
Beams, Philadelphia	1.959	1.759	1.509	1.20
Tank plates, Pittsburgh.....	1.80	1.625	1.32	1.07
Tank plates, Chicago.....	1.99	1.79	1.49	1.20
Tank plates, Philadelphia.....	2.159	1.759	1.509	1.20
Sheets, blk., No. 28, Pbgh.....	2.60	2.22	1.92	1.85
Sheets, blue an., No. 10, Pbgh.	2.25	1.85	1.52	1.35
Sh., galv., No. 28, Pbgh.....	4.75	3.906	3.67	2.85
Wire nails, Pittsburgh.....	2.10	1.87	1.69	1.55
Connellsville fur. coke, contr...	2.35	2.35	1.84	1.69
Connellsville fdy. coke, contr...	3.00	2.96	2.37	2.25
Heavy melting steel, Pbgh.....	17.50	15.31	14.25	10.30
Heavy melting steel, east'n Pa..	16.00	14.50	14.50	9.50
Heavy melting steel, Chgo.....	15.50	13.13	12.00	8.25
No. 1 wrought eastern Pa.....	20.50	17.00	16.00	11.50
No. 1 wrought, Chgo.....	15.50	12.75	10.75	7.50
Rerolling rails, Chgo.....	17.75	14.31	13.15	9.50
Car wheels, Chgo.....	14.75	12.73	11.75	10.00

(For Additional Prices See Page 1302.)

Brisk Holiday Buying of Pig Iron

Transactions in New York Territory Amount to About 30,000 Tons—Many Sales at Philadelphia—Eastern Buying for Last Half

New York, Dec. 28.—Brisk buying of pig iron for this season of the year developed in this territory during the past week. Total transactions were not less than 30,000 tons, most of which were for last half delivery. Freight conditions in this territory show no appreciable improvement, though the railroads are making progress in clearing up their tracks and the Central of New Jersey now will deliver from its lines to outside barges. This is helpful to Brooklyn and other iron consumers in the lighterage zone. The situation in lower New England, especially, still is severe and some foundries are on the verge of shut-down if iron shipments are not speedily received. As an illustration of the present conditions, a Connecticut shop has just received a carload of pig iron shipped from Buffalo six weeks ago.

A Bristol, Pa., buyer has closed for 6,000 tons of No. 2 plain and No. 2X from Buffalo and Pennsylvania makers, last half shipment at $20.33 to $20.58, delivered; the Central Foundry Co. took 5,000 tons additional foundry for last half shipment to Baltimore; the Chrome, N. J., steel maker closed for about 5,000 tons of low phosphorus and bessemer for last half; another buyer closed quietly for several thousand tons of last half foundry. The General Electric Co. asks 2,100 tons of mixed foundry grades for Schenectady, 1,000 tons for Erie, 1,700 tons for Pittsfield and 600 tons for Lynn and 1,000 tons of low phosphorus for Everett and Lynn, a total of 6,600 tons, all for second and third quarter. A Perth Amboy, N. J., steel maker is out for 3,000 tons of second or third quarter basic. Japan wants 3,000 tons of low phosphorus. Tidewater prices on No. 2X are at about $19.75 to $20.25. Buffalo makers are quoting $18 for last half No. 2X. A sale of 300 tons of spot Lehigh valley No. 2 plain was done at $20, furnace, or $20.74, delivered, the buyer being forced into the market by freight delays.

Sales Make Large Total

Philadelphia, Dec. 27.—A surprisingly large amount of new business in pig iron is moving for the holiday season, and it serves to demonstrate the strength of underlying conditions. One seller in this district disposed of 20,000 tons during the past week in miscellaneous business in which many small lots figured, but one large tonnage, closed quietly, also was included. Another seller took from local or nearby consumers orders for 1,500, 1,200 and smaller lots of foundry iron. Most of the larger buying has been for shipment after July. The Virginia Iron, Coal & Coke Co., which has been selling freely for last half, now has over 60,000 tons booked for that delivery.

The tie-up of coke shipments to eastern furnaces has not shown much improvement. The Oxford, N. J., stock remains banked and at least two other furnaces are struggling against such a necessity. A price of $20, furnace for No. 2X foundry continues to be the objective of various makers, and a number of sales are being made at that figure. There are several sellers still below this price, however, and certain brands for last half can be had at about $19.75, Philadelphia, or $18, central Pennsylvania furnace. A Pottstown, Pa., iron mill took 2,500 tons of first quarter and half puddling forge at a range of about $17.95 to $18.50, delivered, or $17 to $17.50, furnace. Other tonnage is pending. One maker now asks $18, furnace, for this grade. Virginia iron continues to move freely, as there are several active sellers. One Philadelphia agent in the week booked a total of about 5,000 tons for first half. It develops that the recent last half purchases totaled about 6,000 tons and included about 4,000 tons of Virginia grades and

1,500 tons of southern Ohio bessemer. Minimum Virginia prices are $17.25 to $17.50, furnace, for first quarter or half and $18 for last half, all for No. 2X. Some buying of low phosphorus for last half is going forward at practically unchanged prices over first half, which are $30, furnace, for standard and $30 to $32 for Lebanon brands. A Chrome, N. J., buyer took about 3,500 tons. A small sale of Lebanon low phosphorus was made at about $40, furnace, for export. Canada continues to put forth a heavy demand. The basic market continues untested. A 6,000-ton inquiry for a Burnham, Pa., buyer remains open.

Buying Small Lots

Pittsburgh, Dec. 28.—Except for the buying of small lots to round out tonnages purchased some time ago, the pig iron market in western Pennsylvania and eastern Ohio is quiet. Indications are, however, that a moderately active buying movement will be witnessed in January or February, since a number of important melters have been sounding the market quietly the last fortnight. A local foundry interest has purchased 1,000 tons of bessemer iron for shipment the next four months at $20.95, delivered. Two thousand tons of the same grade have been sold for export at $20.25, valley, the highest price reported in many years. Standard basic iron has been dull and inactive the last two weeks. Expressions are heard that the prevailing nominal price of $18.50, valley, could not be shaded. No. 2 foundry and malleable grades are selling at $18.50, valley, and above.

Buffalo Prices Higher

Buffalo, Dec. 28.—With the going stacks of the Buffalo district sold up practically solid over the first and second quarters of the new year, the sales booked during the week have been confined almost entirely to resale iron. Some of the grades of the latter have become exhausted and but a limited tonnage of any kind now remains of the large block of pig iron purchased in the spring at this point and held against the advances that have taken place in the market.

The maximum quoted a week ago continues to hold at $20 at the furnace, but the minimum has been advanced to $18 on No. 2X foundry. Either side of this level there is a spread of 25 to 50 cents to cover the minimum asking price for the higher and the lower grades. Basic is being firmly held at a flat price of $20, while the minimum price on malleable iron is equally firm at $19. There is a growing insistence on the part of melters to have the furnace interests consider the needs of the former for the last half of 1916. It is reported that some large users have offered to place their orders without seeking competitive bids from other producers.

The demand for iron under contract is considered remarkable for this season of the year. With the advent of the holiday season, followed by the inventory period at the beginning of the new year, it is customary for the demand to slacken appreciably, but such is not the case this year.

The coke situation is taking on a very serious aspect, insofar as it relates to the needs of the foundries. Melters of the district, it is reported, failed to heed the warning of the producing agencies to order coke for stock.

Another Cleveland Advance

Cleveland, Dec. 28.—Sales for the present month have been heavy in view of the fact that it was supposed that nearly all foundries have covered for their full requirements up to July 1. One sales agency has sold about 70,000 tons and is now quoting $19, valley, on No. 2 foundry. The Cleveland price has again been advanced 50 cents and is $19, furnace, or $19.30, delivered in the city, but a quotation of $18.50, furnace, is still available for delivery outside the city.

Chicago Iron Firm at $18.50

Chicago, Dec. 28.—Northern foundry pig iron, which a week ago was 50 cents per ton lower than malleable, has firmed up to the same level and both grades now are quoted at $18.50, Chicago furnace, for first half, with one interest willing to contract for entire year at the same price. This figure is not guaranteed and an advance of 50 cents per ton is imminent, being expected to make its appearance any day. Relatively this market is lower than others.

Inquiry for both grades is excellent, in lots of 1,000 tons or less. One large interest is in the market for a tonnage for the latter part of the year, but it is not certain a sale will be made as a result of this activity. One lot of 1,000 tons of malleable was disposed of this week at prevailing prices, for a melter outside this city. The inquiry is believed to be less than would be the case were it not the close of the year. As soon as the new year is turned, it is believed that there will be issued in a much heavier inquiry and buying movement. Southern iron is selling at $15, Birmingham, for first half and $10, Birmingham, for second half. This is about the equivalent of northern iron for local delivery, but is lower on delivery to outlying points to the south and west.

The situation as to charcoal iron is unchanged, with considerable sales being negotiated.

Prices Going Higher

Cincinnati, Dec. 28.—One southern stack is still quoting $14.50, Birmingham basis, for No. 2 foundry iron for delivery extending into the first half. Other southern furnaces are holding at from $15 to $15.50, Birmingham basis, for the first half, and from $15.50 to $16 for the third quarter. Southern Ohio stacks have all advanced to $18, Ironton basis, for No. 2 foundry iron for first half delivery, and one has offered to book a limited tonnage for the last half at from $19 to $20. Silvery iron is unchanged and strong at $25, furnace, for 8 per cent silicon, for second quarter delivery, and a premium is asked for spot or first quarter shipment. The Virginia Iron, Coal & Coke Co. has advanced No. 2X iron from its Watts stack, at Middlesborough, Ky., to $16.75, furnace, for the first half, and $18, furnace, for the second half. Virginia No. 2X is quoted at $17.25, furnace, for the first quarter and $17.50, furnace, for the second quarter. Inquiries are light, and a good demand is not expected by dealers here until after the first of the year. Recent sales include 3,000 tons of northern foundry iron to the Jeffrey Mfg. Co., Columbus, O., for last half shipment, 1,000 tons of southern foundry iron to a Louisville melter, and 1,000 tons of northern foundry to a central Ohio user, the latter two for first half delivery.

Moderate Activity

St. Louis, Dec. 28.—Sales of iron in this district last week included 3,000 tons of malleable and quite a number of carload orders. The inquiry for 1,000 tons of basic, and another for 1,000 tons of malleable, which have been before the market for 10 days, neither has been closed nor withdrawn. The inquiry out today is small, and local sales agents are not expecting any big developments until after the holidays. The market is firm and prices are strong. Some southern No. 1, soft, recently was sold at $16 for prompt shipment. Southern No. 2 is held at $15 to $15.50, Birmingham, for prompt shipment. Virginia iron is reported to have advanced $1 a ton today, and dealers are hesitating to quote more than nominal prices.

(*For complete prices see page* 1302.)

Blue Annealed Demand

Passes All Records and Prices Continue to Advance —Galvanized Sheets Not Active

Youngstown, O., Dec. 28.—Business in blue annealed sheets is passing all bounds and prices are rising steadily, the range today being 2.40c to 2.60c, Pittsburgh, for No. 10 gage. Black sheets, on the other hand, are no stronger than a week ago, it being still possible to place a tonnage desirable to the mill at 2.50c, Pittsburgh, for No. 28 gage. Blue annealed sheets, No. 16 gage, are selling about $6 a ton higher than box annealed sheets of the same gage, although it costs about $2 a ton more to make the latter than the former. Independent mills are not taking business more than 60 to 90 days ahead, except in rare instances, although a little attractive second quarter business was taken at 2.75c, Pittsburgh, for No. 28 gage box annealed. Demand for blue annealed and black sheets both for domestic and foreign account continues heavy. Automobile makers are taking large tonnages of both descriptions and the manufacturing demand in general is good. Jobbers also continue in the market actively. Some large tonnages of blue annealed sheets have been taken recently to manufacture coal chutes as a result of improved activity at the coal mines.

Activity in galvanized sheets is less than 25 per cent of normal. The high prices for spelter not only made galvanized sheet manufacturing a highly speculative and dangerous undertaking, but have forced prices so high as to suppress demand to a great extent. Galvanizing roofing, which in former years furnished perhaps the most important consumption of sheets, now is at a standstill. Most sheet makers are not quoting galvanized prices and the few that do base their quotations on costs, which vary from day to day with the price of spelter. One company is quoting on a basis of 4.50c to 6c, for No. 28 gage, according to gage. Another is quoting from 4.75c to 4.85c for No. 28 gage. Some export business continues in this description. A Chinese order was booked recently at 6c, Pittsburgh, for 30 gage, or 5.70c for No. 28 gage.

Active at Pittsburgh

Pittsburgh, Dec. 28.—Demand for steel sheet products is decidedly heavy, and prices reflect strength. The 2.60c price adopted last week by sellers of black sheets has been firmly established, with some mills obtaining $2 and $3 a ton above that figure. Fairly heavy demand for galvanized products is enjoyed, but consumers are buying only for immediate requirements. No. 28 gage galvanized sheets are quoted at a spread from 4.75c to 5c. Blue annealed steel sheets are commanding 2.25c and above for No. 10 gage. Deliveries of steel sheets are deferred from six to 20 weeks. Automobile stock also is decidedly scarce.

Blue Annealed Scarcity

Cleveland, Dec. 28.—The scarcity of blue annealed sheets is the most pronounced factor of the present situation and 2.55c, Pittsburgh, is the minimum quotation of Cleveland mills. The scarcity of sheet bars is serious and mills are offering as high as $45 to cover their requirements for the next few months.

Market Active

Chicago, Dec. 28.—Indifference of sheetmakers who have other outlets for their steel is having an effect on the market. Mills rolling other products have plenty of outlet for their steel in other directions which offer better profits and the production of sheets is being neglected to some extent. Sheet bars are high and scarce and users of this form of steel find difficulty in filling their needs.

No. 28 gage black sheets are obtainable at 2.79c, Chicago mill, on attractive specifications and higher figures are asked by some makers and obtained when delivery is an object.

Galvanized sheets are scarce and prices are high, some makers who ordinarily supply the market being out of business on this grade. Prices range from 4.75c to 5.25c, Chicago.

Demand Better

Cincinnati, Dec. 28.—Demand for sheets is better, but transactions are light, as mills are firmly refusing to sell except for spot shipment, preferring to wait until the future condition of the market becomes more certain before booking first half business. It is also almost as profitable to sell sheet bars to eastern mills as to turn them into sheets. Prices are strong and firm. Black No. 28 gage is quoted at 2.65c, galvanized No. 28 gage at 5c, and No. 10 blue annealed at 2.25c, all Cincinnati basis. Warehouse prices are as follows, Cincinnati basis: Blue annealed No. 10, 2.65c to 2.70c; black, 28 gage, 2.95c, galvanized No. 28 gage, 5.25c.

May Withdraw From Market

Philadelphia, Dec. 27.—Leading eastern Pennsylvania makers of sheets have booked so much tonnage in forward contracts and have such a large amount of specifications in hand that they are contemplating withdrawing from the market and making no more quotations at present. They have more specifications on their books than ever before in history, or sufficient to take up their output for six to eight weeks. Prices with eastern sheet mills are at a minimum of 2.50c, Pittsburgh, for 10 gage, blue annealed, while 2.60c has been obtained in instances.

(For complete prices see page 1302.)

Cast Iron Pipe

Prices Are Firm—Good Buying by Water and Gas Companies

New York, Dec. 28.—Prices in cast iron pipe show firmness and uniformity. On a letting in this city, the past week, they varied only about 25 cents a ton. The usual quotations at present are $26.50 at the foundry, or $28, New York, for 6-inch class B and $3 higher for 4-inch. There is good buying by the water and gas companies and other private consumers for shipment beginning almost immediately and some public needs are offered for spring delivery, but the tonnage of the latter up to the present, is not heavy. R. D. Wood & Co. have received 1,100 tons of 4 to 16's for the Rochester Railway & Light Co. and the United States Cast Iron Pipe & Foundry Co. 420 tons of 6 to 20's for Altoona, Pa., at $28, delivered. Springfield, Mass., is in the market for 1,014 tons of 4 to 16's. Camden, N. J., has taken bids on 500 to 1,000 tons of 4's, 6's and larger and Trenton on 500 tons of 4 to 12's. The Consolidated Gas Co., this city, is in the market for 400 to 500 tons.

Pipe Business Light

Chicago, Dec. 28.—Little business is presenting itself in cast iron pipe, this being between seasons. Practically nothing is pending actively. The United States Cast Iron Pipe & Foundry Co. has been awarded 400 tons at Muscatine, Ia.

With the cost of pig iron rising steadily, quotations on cast iron pipe are rising also and a further advance from present levels is expected to be made by the first of the year.

Carry Over Bar Tonnage

Undelivered Orders Will Be Taken Care of in New Year—Heavy Inquiry for Munitions

Philadelphia, Dec. 27.—Some of the large makers of steel bars will carry over into the new year so heavy a tonnage of undelivered business against 1915 contracts, that they cannot take on any further requirements before July; furthermore they do not care to quote at present on last half needs which several consumers now have in the market. Consequently, they are completely out of the market and are not quoting at all. One or two large producers, however, while not naming prices for last half, have been taking on some second quarter tonnage at 1.80c, Pittsburgh. One important maker of shafting also has withdrawn from the first half market.

Steel Bars for Export

Chicago, Dec. 28.—Steel mills steadily refuse to book tonnages for last half delivery, or even for third quarter delivery in the usual way. However, considerable tonnage in the aggregate is being taken for delivery after July 1 on definite projects, car and ship building, rails and buildings. Added to this is expected to be considerable tonnage left over on books from business already there for first half delivery.

With orders that could be booked as soon as word is passed that makers are willing to take tonnage, third quarter business is already in sight. One sales manager believed books will be open not more than a day on third quarter business before they will be filled and closed.

Some foreign tonnage is actively in the market here for last half delivery, for war purposes, and probably will be placed shortly, well distributed among makers. Inquiries for export steel for other than war purposes are coming in, Australia, France, Russia and Italy being represented, usual sources of supply being closed by war.

Prices are uncertain as to the maximum. A nominal quotation of 1.99c, Chicago, is current, but practically nothing is available at that figure. Mills able to make reasonable deliveries are receiving large premiums.

Specifications Heavy

Pittsburgh, Dec. 28.—Specifications against contracts for steel bars have been coming out in heavy volume this week, but not much new buying is reported. Numerous inquiries have been sent out by representatives of entente nations for shrapnel steel for shipment after July 1, which indicates that the allies do not believe the campaign will end at an early date. The refusal of trunk line railroads to accept additional tonnage for export, because of the congested traffic conditions in the east, brought relief to domestic consumers, since mills have diverted as much steel as possible to domestic buyers. Steel bars are quoted at a minimum of 1.80c for shipment at the convenience of the mill. An early advance in price is expected. Bar iron is selling at 1.90c.

Heavy Inquiries for Munitions

Philadelphia, Dec. 27.—Heavy inquiries for both shell steel and finished shells for European delivery are being laid before eastern Pennsylvania steel and munition makers. The Russian commission this week asked for 200,000 5-inch high explosive or shrapnel shells, delivery to begin in January at 40,000 to 80,000 monthly. This order would require about 13,500 tons of steel. Another inquiry is for 150,000 6-inch shells for the British, weighing 180 pounds each, also for early shipment. The steel requirement is about 11,000 tons. Roumania has some new inquiries for shells in the market. The inquiries for round or square bars, blooms or billets now in the market for last half shipment abroad now reaches an enormous tonnage. Few sales yet have been made, however. Most of the large domestic inquiries, including 30,000 tons of 7¼-inch squares for eastern Pennsylvania delivery are to cover prospective orders for munitions not yet booked by these manufacturers.

Nominal Prices

Youngstown, O., Dec. 28.—Steel bars are quoted nominally about 1.90c to 2c, Pittsburgh, and steel plates 2c. Certain steel sheet makers, booking foreign orders, have been forced into the open market for plates, which they were compelled to book, in order to get the sheets. These mills have run up against various prices in their shopping around. In one instance a plate maker outside this district offered to book a small tonnage at 3c for delivery the first quarter of 1917, while others refused to quote at all, for any delivery. A sheet producer bought a tonnage of plates at 2.35c, Pittsburgh, prompt delivery, and sold it at 2.50c., for shipment to South America.

Bar Iron Strong

Chicago, Dec. 28.—Bar iron in this territory continues strong and is beginning to feel more perceptibly the effect of deferred deliveries of steel. The full effect of this condition of the steel market is expected to manifest itself during first quarter. Mills here still have some capacity for prompt delivery of iron bars, but have sufficient bookings to keep them busy through January and February at full operation, though schedules would allow some tonnage to be squeezed in for earlier delivery.

Some iron has been contracted at 1.80c, Chicago mill, though 1.75c, Chicago still can be done. It is believed the market will go to the former figure shortly.

Hoops, Bands, Shafting

Pittsburgh, Dec. 28.—Prices below 45 per cent off the list for steel shafting gradually are disappearing; indications are that the market will be quotable at the figure a week or 10 days hence. Manufacturers are not offering additional tonnage for first half delivery. Hoops are firmly held at 2c and bands are quoted at 1.80c. Cold rolled strip steel products are nominally quoted at 3.50c base; some makers are quoting as high as 4c, base.

(For complete prices see page 1302.)

Wire Advance

Results in Specifications Coming in Larger Volume

Pittsburgh, Dec. 28.—The advance of $2 a ton announced last week by manufacturers of wire products tended to stimulate activity. Specifications have been coming out in heavier volume, and some new buying has been enjoyed. Several mills report sales on the basis of $2.10 a keg for nails, the highest price to prevail in many years. Several mills temporarily have discontinued the rolling of material for export, because of the railroad embargoes against the shipment of wire and other commodities abroad. This greatly has benefited the domestic market. Generally, mills are unable to assume additional obligations for shipment the first half of 1916.

A Massachusetts manufacturing company has signed contracts for $900,000 worth of machinery for the establishment of two modern cotton-spinning mills in Tien-Tsin, China. The mills are to have 250,000 spindles, and are to be capable of expansion to double that number after sufficient labor has been trained.

Plate Makers

Are Overwhelmed With Specifications—High Prices Freely Paid

Philadelphia, Dec. 27.—Some of the eastern plate makers continue to grapple with the problem as to the most equitable manner to distribute the production since specifications on hand already will absorb their output for months ahead and a fresh rush of mill orders is expected this week with the expiration of year-end contracts. One mill reports specifications entered for four months' full rolling, another for six to eight weeks and a similar condition extends all along the line. Considerable new business is appearing constantly which the makers exert efforts to avoid. Actual sales in smaller quantities have been made by eastern Pennsylvania makers at 2.35c, Pittsburgh. The usual minimum price quoted is 2.25c, Pittsburgh, and the maker applies this only to the best of regular customers while to others 2.75c, Pittsburgh, is quoted. Much boat tonnage still is stirring.

Plates May Go Higher

Pittsburgh, Dec. 28.—Shipments of finished steel products to domestic consumers have been somewhat better since the declaration of railroad embargoes making it impossible to ship additional tonnage to the eastern seaboard for export. Demand has been sufficiently heavy to absorb the temporary increase in tonnage for domestic distribution. The Carnegie Steel Co., the Jones & Laughlin Steel Co. and other manufacturers of finished material have not yet opened books for shipment after July 1. It is not unlikely that the prevailing minimum price of 1.80c for shipment at the convenience of the mill will be withdrawn at an early date.

Cleveland Mills Busy

Cleveland, Dec. 28.—Cleveland mills are extremely busy and are getting more business than they can take care of, with 2.50c, Pittsburgh, as the minimum and sales are being made as high as 2.75c and even 3c, Pittsburgh, for delivery ranging from two to three weeks to six weeks. One company which is selling flange and fire box grades almost exclusively is selling on a basis of 2.75c to 3c for tank steel with full extras for other grades.

Plates Continue Strong

Chicago, Dec. 28.—Plates continue the most sought finished steel product, as railroads still are seeking additional rolling stock and builders are pressing the maker of plates strongly for material. Other consumers of plates are equally insistent and material is most difficult to obtain.

Nominal quotations of 1.99c, Chicago mill, represent the minimum of the market and premiums are large for early deliveries with most capacity absorbed for some distance into the future.

Billet Market

Reflects Great Strength—France Inquires for 40,000 Tons of Blooms

Philadelphia, Dec. 27.—An inquiry for 40,000 tons of 10-inch blooms for France, delivery to begin at an early date, has been laid before eastern makers by J. P. Morgan & Co., but could not be accepted because the capacity was not available. Some business of this kind for later delivery, however, is under consideration and probably will be booked. A Philadelphia company with a rolling mill has been inquiring for 6,000 tons of 4 x 4-inch rolling billets for 1916 delivery, which are to be reduced to shrapnel rounds. An eastern Pennsylvania steelmaker who recently has been active in taking billet orders for second quarter, has speedily disposed of practically all its tonnage for that period and now is out of the market. It sold rolling billets as high as $42, mill, and forging steel up to $60, mill.

Semi-Finished Jumps Up

Pittsburgh, Dec. 28.—The market for semi-finished steel products in western Pennsylvania reflects considerable strength. Open hearth billets and sheet bars are being held at $35, mill, and above, or from $3 to $4 a ton above previously prevailing nominal prices. One mill has formally declined to accept orders at $35, mill. Most consumers have covered first quarter requirements. Railroad embargoes against the shipment of material abroad through New York have released considerable tonnage for distribution among domestic consumers, which will temporarily relieve the situation. Forging billets continue to command abnormally high prices, $55, Pittsburgh, representing the minimum of the market. Wire rods are not being offered by manufacturers in this district; they nominally are listed at $40, Pittsburgh. Muck bar is quoted at $34, Pittsburgh, and above.

Nothing for Sale

Youngstown, O., Dec. 28.—The available supply of semi-finished steel continues about as plentiful as snow in July. Practically no steel is for sale in the open market by valley makers and prospects are that the next few months will show no slackening in the situation. Regular customers arranged for their first quarter requirements some time ago and buying for the second quarter is expected next week. Sheet bar consumers say their principal worry just now is regarding deliveries of steel contracted for the fourth quarter of 1915, rather than contracts for the second quarter of 1916. First quarter steel was booked at prices ranging from $26 to $29, Youngstown, and it is believed second quarter material will be taken at from $31 to $35. Nominal prompt quotations for bessemer billets and sheet bars range from $33 to $34, Youngstown, and for open hearth billets and sheet bars, $34 to $35, Youngstown.

(*For complete prices see page* 1302.)

Seek Cast Scrap

New York, Dec. 28.—An active demand for cast scrap by the foundries in local territory has been a conspicuous development of the week in old material. The supply of this grade is limited, however, and bids of consumers have forced up the market $1 a ton or more to $15.50, delivered Jersey points, with $16, delivered, reported. Only small sales are to be noted. It is thought that perhaps the delays in pig iron shipments by freight blockades may have contributed to this sharp demand for cast scrap. Wrought material continues to command very high prices. Long wrought equal to No. 1 railroad has been sold at $22, delivered eastern Pennsylvania, and dealers believe $23, delivered, for No. 1 railroad can be obtained. For city wrought, $20, delivered, is offered and for shafting, $21, delivered. Heavy melting steel continues quiet.

Nuts, Bolts and Rivets

Pittsburgh, Dec. 28.—Manufacturers of nuts, bolts and rivets are expected to advance prices shortly after Jan. 1 to meet recent increases in the cost of steel bars. Structural rivets have been established at 2.50c and prevailing prices of nuts and bolts are firm. Fairly heavy tonnages for export continue to be booked in this district.

Swayne & Co., dealers in coal, pig iron, etc., have removed their offices from the Land Title building to Nos. 1814 and 1815, Pennsylvania building, Philadelphia. Noah H. Swayne 2nd, the head of this firm, formerly was Philadelphia manager of Rogers, Brown & Co.

Ferro Advanced

By English Makers, Who Are Now Quoting $110 Seaboard

New York, Dec. 28.—Increased demand for ferro-manganese from consumers in this country has caused English makers to announce an advance of $10 a ton, effective Dec. 27, to $110, seaboard. The last previous change in the official English schedule was on May 14, when the price was advanced from $88 to $100, seaboard. The new price of $110, seaboard, of necessity, applies to forward deliveries, since such shipments as now are being received from England are against old contracts. Some agents of the English makers are quoting the new price only for shipment from England in March or later. Several thousand tons already have been sold for first half at the advanced price. Some holders of spot material are asking $135, seaboard.

Continued uncertainty and irregularity of shipments of ferro-manganese from England, together with the present rapid rate of consumption, recently have caused consumers to show more concern over their supplies and they have been coming freely into the market for both spot and forward delivery. Since Dec. 1, it is estimated, sales have totaled about 15,000 tons. Very little spot material has been available, but a few hundred tons of English metal for immediate shipment were sold within the week at $110, seaboard, before the new advance went into effect. A number of new contracts for shipment up to July 1 also were booked at $100, seaboard. Offers at this figure, involving hundreds of tons, were rejected by English makers in announcing the new price.

The steamship MALVERN RANGE, carrying about 3,500 tons, or the largest cargo sent from England in some months, has finally arrived at Baltimore, after prolonged expectations. This vessel carries monthly quotas for different agents which were promised in November. It is clear that the English producers are having difficulty in maintaining monthly deliveries against contracts on the scale they had promised, and this factor has contributed to the strength of the market for early delivery.

About 1,500 tons of spiegeleisen are in the market. Additional sales of the domestic product at $30, furnace, for 20 per cent are noted.

Ferro Higher at Pittsburgh

Pittsburgh, Dec. 28.—English makers of 80 per cent ferro-manganese have advanced prices $10 a ton to $110, seaboard; sellers of domestic material are quoting $125, seaboard. The market has been active and strong this month. Lower grades of ferro-silicon are being held at premium prices for shipment before April 1. Fifty per cent material is active and the prevailing price is firmly maintained. No change is noted in the situation for steelmaking metals; all grades continue scarce and prices which represented the market a few weeks ago are nominal.

Tin Plate

Has Advanced $3 and Still Higher Prices Expected

Pittsburgh, Dec. 28.—Independent manufacturers of tin plate have advanced prices $3 a ton to $3.75 per 100-pound cokes, f. o. b. Pittsburgh. The trade had expected the advance for some time; it is not unlikely that material will be held at $4 before April 1. The leading interest has made no change in price since the opening of books Nov. 11 for the 1916 season. Tin plate manufacturers have been beset with numerous difficulties the last six months. Sheet bars and sulphuric acid have been scarce and deliveries are uncertain. The pig tin situation also has been problematical.

Rush of Business

Cleveland, Dec. 28.—Tin plate makers report a rush of business since the recent advance in prices by independent sellers from $3.60 to $3.75 per 100-pound box. Makers are not clinging to the sales policy of previous years when a large part of their output was contracted for a year in advance, but are making as few of these contracts as possible. While some of the large western packers who protested against the increase from 1915 quotation of $3.20 have covered for part of their 1916 requirements at the recent higher prices, a large number have not come into the market, possibly believing that their stock of tin plate will carry them past the high price period. Export demand continues in large volume. Independent sellers say they would not be surprised if the next few months brought about a still further advance in tin plate, possibly to $4.

The Model Foundry & Machine Co., of Findlay, O., have elected the following officers: President, J. Kwis; vice president, Arthur Hosler; secretary and treasurer, A. C. Heck. Directors, A. C. Heck, J. J. Kwis, Arthur Hosler, Paul Reissig, Richard Gohlke, Fred Kwis and Harry Tarbox.

(*For complete prices see page* 1302.)

Metal Markets

Show Activity in Copper—Tin Strong—Spelter Quiet

New York, Dec. 28.—The copper market has reflected great activity during the week, due mainly to heavy purchases of this metal by the British government, for delivery over the next three or four months. A large amount of business also has been booked from other sources, so that producers are more comfortably situated than in months. Prices have advanced steadily and the market now is quoted as follows: Electrolytic 22c, delivered 30 days; ordinary casting copper, 20.75c to 21c, cash; best brands of lake copper, 22.25c to 22.50c, cash; ordinary and arsenical lake, 22c to 22.25c, cash. The trade expects higher prices.

The tin market is strong, due in a large measure to war developments, as the restriction of exports from the United Kingdom, the expected interruption of traffic through the Suez canal, etc. The market has been quiet but there is a good demand today. Quotations are as follows: Spot, 39.25c to 39.50c; January, 39c; February, 38.50c; March, 38c, etc.

The spelter market has been exceedingly quiet; while there has been considerable inquiry, sales are few and producers have very little of the metal to sell for prompt or nearby delivery. The market on prime western is nominal as follows: Spot, 17.25c to 17.50c, St. Louis; January, 16.50c to 16.75c; February and first quarter, 15.75c to 16c; second quarter, 13.75c to 14.25c.

The lead market is strong but quiet. The American Smelting & Refining Co. still asks 5.40c, New York, and 5.32½c, St. Louis, and it is difficult to get material at this level from independent producers, who are well sold ahead.

The antimony market has advanced due to small stocks and an improved demand. Chinese and Japanese brands for spot delivery are quoted at about 39.50c, duty paid. Somewhat less can be done on futures.

The aluminum market, like some of the other metal markets, is affected by the embargo which the railroads have placed on freight for shipment to the east. The New York market on No. 1 ingots in carload lots may be quoted at 56c to 58c; it is likely that lower could be done in the middle west. The market is dull.

The Scovill Mfg. Co., Waterbury, Ct., has declared an extra dividend of 5 per cent, besides the regular quarterly dividend of 2 per cent, payable Jan. 1.

Canadian Scrap Embargo

Stopping of Exportation From Dominion Causes Protest of American Manufacturers

Buffalo, Dec. 28.—An embargo on the exportation of wrought and steel scrap from Canada into the United States, effective Dec. 27, has been placed by the Canadian government. As far as it applies to steel scrap, it is reported that serious objection to the order will be raised in this country. No objection is likely to be raised against the wrought scrap embargo.

Mills of the United States, it is claimed, are sending into Canada fully three-quarters of the billets used by the Canadian interests in the manufacture of shells, and the scrap resulting from the latter operation, it is contended, should be permitted to flow back into this country to meet the needs of American steelmakers.

Cutting off the exportation of steel scrap is serious enough, it is claimed in this market, to cause mills here producing billets for Canadian users to curtail to the limit shipments into Canada. The matter of withdrawing the steel scrap embargo before retroactive measures reach the Canadian shellmakers is being taken up at Ottawa and also on this side of the border.

The future of the old material market for the week is the sharp advance of $2.50 per ton on bundled tin scrap. Heretofore, owing to limited trading, the commodity has been quoted from week to week with slight or no variation. The several producers of tin scrap have been subjected, it is claimed, to a market controlled for a long period by not to exceed three de-tinning corporations.

Recently a fourth consumer appeared in the market to pick up Buffalo stocks at prices not at all in accord with the nominal figures quoted by the so-called trio of older users. One Buffalo seller has just closed a contract taking over the entire supply for the coming year of this producing interest and at prices figured at close to $16 per ton. The sale of this tonnage and the activity of the new consumer in the market has caused the price of bundled tin to advance from $13 to $15 to $15.50.

Strong for This Season

Philadelphia, Dec. 27.—The old material market in this district manifests the usual contraction in sales of the holiday season, but the volume of business is larger than it usually is at this period of the year. Strength is displayed in practically all grades. Consumers' prices on heavy melting still remain in doubt, as there is practically no buying and freight embargoes at the two Coatesville mills with a similar ban threatened at the Schuylkill valley works, tends to check fresh purchases. It is indicated, however, that round tonnages would bring considerable advances. The brokers continue to buy steel of one another. Wrought material still is a leader in strength. No. 1 railroad has been done at $22, delivered, eastern Pennsylvania, with $21 to $21.50 the usual prices. Wrought pipe in one case this week was sold at $16.50, delivered, and in another $16, delivered. Borings and turnings are 50 cents higher. Several sales of No. 1 heavy cast have been made at $17, delivered, but there were sellers this week at $16, delivered.

Quiet at Pittsburgh

Pittsburgh, Dec. 28.—The iron and steel scrap market in the Greater Pittsburgh district is quiet. Heavy melting steel, which sold at a spread from $17.50 to $18.50 a fortnight ago now is quoted at a range from $17.50 to $18, delivered. More important melters covered needs for the remainder of the year the early part of this month. Low phosphorus steel scrap continues its march toward higher levels; this grade is listed at $21.50 a ton as a minimum.

Melting Steel Higher

Cincinnati, Dec. 28. — The iron and steel scrap market is moving along smoothly in regards to both new orders and shipments. The latter are especially heavy, as rolling mills and jobbing foundries are specifying large tonnages each week. Heavy melting steel is now quoted at from $14.50 to $15 per gross ton, with the lower figure being offered by the majority of dealers. The best sellers in the market at present are No. 1 bushelling, stove plate, No. 1 machine cast, heavy melting scrap and bundled sheet scrap.

Chicago Scrap Steady

Chicago, Dec. 28.—Chicago's scrap market is standing still, apparently awaiting the turn of the year before doing anything definite. Large consumers have bought sufficient material in the past to insure operations and deliveries are being received steadily. Sellers had the material in hand and no short interest followed, which fact is responsible for the present quiet.

Railroad offerings are not large, the season being adverse to picking up scrap along the lines. The Chicago, Milwaukee & St. Paul railroad offers 2,500 tons, of which 1,000 tons consists of car wheels; the Chicago, Burlington & Quincy railroad offers 1,700 tons; the Monon railroad 300 tons, and the Rock Island railroad 3,600 tons.

(*For complete prices see page* 1302.)

Coke Fluctuates

Considerable Change in Prices During the Past Week

Pittsburgh, Dec. 28.—Prices of Connellsville coke have fluctuated considerably the last couple of weeks. Two weeks ago furnace fuel was offered at $2.25 for spot delivery; on Dec. 24 sales at as high as $3.90 were reported; this morning, some dealers offered to accept orders at $3.20 a ton at the ovens. Foundry coke has been selling at a spread from $3 to $4.25, ovens, the last two weeks. Observance of Christmas caused a partial cessation of operations at coke plants, but consumers apparently had accumulated sufficient tonnage to meet requirements. No sales of fuel for future delivery have been reported, and the contract market is unchanged in position. The *Connellsville Courier*, for the week ending Dec. 18, says production was 446,385 tons, a decrease of 5,511 tons compared with the week previous.

Price Advance Expected

Cincinnati, Dec. 28. — Wise county coke is holding at the higher level to which it advanced last week. Furnace grades from this district are quoted at from $2.85 to $3.10, ovens, and foundry grades at from $3.25 to $3.50, ovens. New River and Pocahontas prices are unchanged at from $3 to $3.50, ovens, for furnace coke from the former, and from $2.75 to $3, ovens, for the same grade from the latter. No new developments are expected until after the first of the year, when another advance is predicted by oven operators, because of the acute shortage of furnace coke now existing, and of heavy shipments on foundry grades.

Dull at St. Louis

St. Louis, Dec. 28. — Coke is dull, and buyers are experiencing some difficulty in getting deliveries. There is very little inquiry out, but prices for standard foundry grades are firm at $3.50 to $3.75, ovens.

Shape Tonnage

Is Satisfactory for This Time of the Year—Good Prospects in East

New York, Dec. 28.—Good prospects for future work in eastern territory continue to be ascertained by leading fabricators. The outlook for a liberal tonnage from the railroads for spring delivery continues to improve and from the amount of propositions now in the architect's hands in this district, building work will show much activity at a later season. The new tonnage in the market continues very good for this season of the year. A new 11,000-ton elevated requirement for the Interborough Rapid Transit Co. is up for figures. Fabricating prices show improvement in general, but here and there comparatively low figures still appear. Plain material prices are very strong at from about 1.859c to 2.159c, New York, with the tonnage limited at the inside figure. Bethlehem sections now have been advanced to 1.85c and 1.90c, Pittsburgh.

Still Quote Varied Prices

Philadelphia, Dec. 27. — Lack of uniformity in structural shape prices still characterizes the eastern Pennsylvania market. It has been clearly demonstrated by recent events that large buyers will pay 2.00c, Pittsburgh, for accommodation at the mills convenience. The eastern buyer who recently took 2,000 tons at that price offered to accept a duplicate amount at the same figure, but the mill was unable to receive the business, because its specifications now total three months' output. The 2.00c, Pittsburgh price, for standard shapes is followed by most of the eastern Pennsylvania producers. One mill, however, it is reported, still is accepting as low as 1.85c at its plant for some orders. A large eastern Pennsylvania maker of special shapes now asks 1.85c, Pittsburgh, minimum. New tonnage is quite good, though not heavy.

Bridge Material Awarded

Cleveland, Dec. 28.—The King Bridge Co. has taken a contract for 4,000 tons of structural material for the Cleveland & Youngstown railroad for bridge work within the city limits. Inquiries for several thousand tons of bridge material for the Burlington are pending. An eastern steel company is quoting 2.25c at its plant, or 2.45c, Cleveland.

Domestic Shipments Better

Pittsburgh, Dec. 28.—New buying of structural material has not been heavy the last 10 days, but this is not an unusual occurrence at the close of the year. The domestic situation has been relieved to some extent by the placing of railroad embargoes against the shipment of additional material to foreign ports. Structural shapes are selling at 2c and considerably above for prompt delivery; the 1.80c figure has not been withdrawn for shipment at the convenience of the mill. Leading manufacturers have not opened books for third or fourth quarter shipment.

Shapes Remain Active

Chicago, Dec. 28.—Structural activities in the west remain good, industrial and mercantile building and public institutions, making up a fair total tonnage. Fabricators with tonnages reserved at former low prices are able to take on considerable business in competition with others forced to bid on the basis of present mill prices and this is a temptation to builders who feel they can beat the market.

Structurals are quoted nominally at 1.99c, Chicago mill, but reasonable deliveries command a premium of considerable dimensions.

CONTRACTS AWARDED.

San Francisco City hospital, two wings, nurses' home and administration building, 1,400 tons, to Dyer Bros.

Building for St. Louis Dispatch, St. Louis, Mo., 1,308 tons, to Christopher & Simpson.

Duluth, Missabe & Northern railroad, Lawrence lake viaduct, Bovey, Minn., 469 tons, to American Bridge Co.

Factory for Amalgamated Sugar Co., Twin Falls, Idaho, 450 tons, to American Bridge Co.

Redding high school building, San Francisco, 325 tons, to Golden Gate Iron Works.

Palace theater building, St. Paul, Minn., 290 tons, to Herzog Iron Works.

Union Furnace Co., Buffalo, 9-ton ore handling bridge, 275 tons, to McClintic-Marshall.

Residence for Agnes M. Bourn, San Mateo, Cal., 260 tons, to Vulcan Iron Works.

Addition to Standard Oil Building, San Francisco, 200 tons, to Ralston Iron Works.

Bridges and transmission towers, involving 3,500 and 1,800 tons respectively, for the International Railway Co., for a line extending from Buffalo to Niagara Falls, awarded to the American Bridge Co.

Building for the chamber of commerce, Rochester, N. Y., 520 tons, awarded the American Bridge Co.

Four story building for the Westinghouse Machine Co., 800 tons, awarded the McClintic-Marshall Co.

Ore bridge for the Mead-Morrison Mfg. Co. at Buffalo, 300 tons, awarded the McClintic-Marshall Co.

Municipal General Hospital, Buffalo, six buildings, taking 700 tons structural, contract to Kellogg Structural Steel Co., Buffalo.

McKeon street pier, Philadelphia, 5,000 tons, now formally awarded to the American Bridge Co.

Power plant for the New York Steam Co., Burling Slip, New York, 1,400 tons, to Milliken Bros., Inc.

Hudson County jail, Jersey City, 1,500 tons, reported will be supplied by the Fagan Iron Works.

(For complete prices see page 1302.)

Studio building, West Fifty-seventh street, New York City, 250 tons, to the W. B. Shafer Co.

Building for the Anaconda Copper Mining Co., Anaconda, Mont., 400 tons, to an independent shop.

Bridge work, including 900 tons, for the Chicago, Hamilton & Dayton and 200 tons for the Baltimore & Ohio at Chicago, to an independent shop reported to be the Mount Vernon Bridge Co.

Bridge work at Warren, Mass., and at Rensselaer, N. Y., for the Boston & Albany, 225 tons, divided between the Boston Bridge Works and the New England Structural Co.

Bridge work, Cleveland & Youngstown R. R., 4,000 tons, to King Bridge Co.

CONTRACTS PENDING.

Extensions to the plant of the Samuel L. Moore & Sons Corporation, Elizabethport, N. J., 1,200 tons, revised bids being taken.

Addition to Y. W. C. A. building, 124th street and Lenox avenue, New York City, 1,000 tons, expected to go to the Phoenix Bridge Co.

Repair shop, Knoxville, Tenn., for the Southern Railway Co., 300 tons, bids being taken.

Additional bridges for the Cincinnati, Hamilton & Dayton railroad, 400 tons, bids being taken.

Elevated railroad extensions of Webster avenue, West Farms and Eighth avenue lines in the Bronx, New York City for the Interborough Rapid Transit Co., about 11,000 tons, bids to be taken Jan. 10.

Pipe More Active

Pittsburgh, Dec. 28.—The Philadelphia Co. has opened negotiations for 10,000 tons of iron pipe to meet 1916 oil country requirements. Prices of iron and steel pipe have not been changed since Nov. 1. The trade has expected that higher quotations would be adopted before the end of the year. Demand for boiler tubes and for seamless tubing continues decidedly heavy, and prices are firm.

Heavy Demand

Youngstown, O., Dec. 28.—Wrought pipe makers state that demand for this product is the heaviest in 15 years, at least, owing to the rush of oil country development and the activity in the building trades, where preparations on a large scale are being made for next spring. Valley sellers are pursuing a conservative sales policy, booking orders for only prompt or nearby delivery. A further advance in prices would not be surprising, the last having taken effect Nov. 1, while prices of other iron and steel products have taken long strides since then.

B. H. Campbell, of Elwood, Ind.; E. G. Scotten, of Newcastle, Ind., and L. A. Coleman, of Indianapolis, are at the head of a company capitalized at $10,000, which has been organized to take over and control the foundry department of the defunct Elwood Iron Works.

Rail Orders

Being Placed for Delivery in Second and Third Quarters

New York, Dec. 28.—A number of miscellaneous orders for rails for delivery in the second and third quarters, now are being placed by the railroads. These delivery positions are the best that the mills now are able to offer, though some of the roads have wanted earlier shipment. The Southern railway has ordered 12,000 tons additional for delivery in the second quarter from the Maryland Steel Co. and still has 6,000 tons to act upon. The Maryland Steel Co. also has taken 4,200 tons from the Seaboard Air Line. The Lackawanna Steel Co. has received 5,000 tons for the Burlington, 4,000 tons for the International Railways of Buffalo, about 2,500 tons for the International Great Northern and 4,000 tons for the Cuban railways. A final distribution of the Great Northern's recent rail order gave 10,000 tons to the Illinois Steel Co. and 5,000 tons to the Bethlehem Steel Co. The Delaware & Hudson railroad, which has been inquiring for rails, is reported to have closed with the Bethlehem Steel Co. Some girder rail business is in the market, but up to this time the street railway lines have not been buying very freely.

Orders for passenger equipment have been the most active in the car market. The New York Central system bought 105 coaches, of which 45 went to the American, 45 to Standard and 15 to Barney & Smith. The Missouri, Kansas & Texas ordered 15 baggage, two passenger and four diners from the American Car & Foundry Co., the Erie five coaches and one baggage from the Pressed Steel Car Co., while the Burlington closed for nine passenger and baggage, five passenger and eight diners. The Duluth & Iron Range ordered 100 flat cars from the American Car & Foundry Co.; the Houston Coal & Coke Co., 100 mine cars from the Pressed Steel Car Co., and the New Haven closed for 25 milk cars. New inquiries include 1,000 box cars for the Denver & Rio Grande, 100 gondolas for the Bethlehem Steel Co., 40 ore cars for the Pittsburgh Steel Co. and 30 gondolas for the American Steel & Wire Co. The Central of Vermont is about to buy equipment, but has not yet issued definite inquiries.

Union Pacific Seeks Cars

Chicago, Dec. 28.—The Union Pacific railroad is asking bids on 2,000 cars. Of these 1,000 are steel underframe box cars, 500 are steel frame and underframe box cars and the remaining 500 of various types. The Denver & Rio Grande is asking figures on 1,000 steel underframe box cars.

Locomotives for Russia

The H. K. Porter Co., Pittsburgh, has received an order from the Russian government for 20 locomotives, in addition to an order for 35 locomotives taken some time ago.

Shells for France

Although it is understood some of the details remain to be settled, the Midvale Steel & Ordnance Co. has practically closed for a large order for shells for France, which some newspaper statements represent as calling for 400,000 8½ to 12-inch shells, valued at about $30,000,000. Further large negotiations for shell contracts with the allies are being carried on by the Midvale company. Current reports are that a considerable portion of these contracts are to be sublet to the Baldwin Locomotive Works.

More Boats Change Hands

Oglebay, Norton & Co., iron ore dealers, Cleveland, and Capt. W. C. Richardson, vessel man of that city, have purchased five steamers of an aggregate capacity of 38,000 tons of ore per trip for about $1,400,000. The ships will be managed by W. C. Richardson & Co. and will carry ore for Oglebay, Norton & Co. The ships are HARVEY D. GOULDER and WILLIAM LIVINGSTONE, formerly Tomlinson boats; the WAINWRIGHT, purchased from Edward Mehl, of Erie, Pa., and SENATOR and COLONEL, purchased from C. H. McMillan, of Detroit.

Chicago Prices Advanced

Chicago, Dec. 28.—An advance of $2 per ton on steel products from store has been announced in Chicago. This affects St. Louis and St. Paul prices in equal degree.

Demand is strong and with mills unable to deliver except at several months distance consumers are calling on stores for large necessities.

Christmas Party.—The Pittsburgh Foundrymen's Association held a Christmas party at the Fort Pitt hotel, Pittsburgh, Dec. 20. Following an English dinner, a musical program was enjoyed. F. H. Zimmers, secretary of the association, in the role of Santa Claus, presented appropriate presents to many of the foundrymen.

(*For complete prices see page* 1302.)

Neale Goes to Midvale Steel Co.

President A. C. Dinkey, of the Midvale Steel Co., announces the appointment of John C. Neale as general manager of sales for the company, effective Jan. 1, 1916. Mr. Neale will have complete charge of all sales matters and will be located at the general offices of the company in the Widener building, Philadelphia. President Dinkey also announces that Mr. Neale will serve in a similar capacity for the Worth Bros. Co. Mr. Neale was formerly in charge of the general plate and structural sales of the Carnegie Steel Co., with headquarters at Pittsburgh, and more recently has been president of the Central Steel Co., Massillon, O.

New Duluth Company

Fred H. Waldron and Roger M. Woodbridge have organized the Waldron-Woodbridge Co., Duluth, Minn., which has become the representative of the Chicago Pneumatic Tool Co., the Deister Concentrating Co. and a number of other machinery companies. The company has closed considerable business and has much more pending. Mr. Waldron is a graduate of Sheffield Scientific School of Yale University and Mr. Woodbridge, who is a son of Dwight E. Woodbridge, the well known mining engineer, has had several years of college work in mining and several years of practical work in mines.

Waddell Resigns

Youngstown, Dec. 29. (By wire.) — Jacob D. Waddell, manager of sales of the Brier Hill Steel Co. since its organization four years ago, has resigned effective Jan. 1. He was with the Empire Iron & Steel Co., Niles, before becoming connected with the Brier Hill company. He will build a sheet mill in this vicinity, having interested capital to insure the success of the venture. He will be succeeded by P. H. Hubbard.

The Westinghouse Electric & Mfg. Co., Pittsburgh, has declared the regular quarterly dividend of 1½ per cent on the common and 1¾ per cent on the preferred stock. The common dividend is payable Jan. 31 and the preferred Jan. 15.

The Trumbull Steel Co., Warren, O., has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Jan. 1. Books closed Dec. 21.

Brier Hill Steel Co. Sales Offices

In order to expedite the handling of mail and shipment of goods, the Brier Hill Steel Co., Youngstown, O., has discontinued the operations of its subsidiary plants, the Garry Iron & Steel Co., Niles, O.; the Garry Iron & Steel Co., New York, and the Empire Iron & Steel Co., Chicago, and will handle its business through its district offices, and under the supervision of district managers of sales, as follows:

Pacific Coast District: A. C. Rulofson, 345 Monadnock building, San Francisco.
Southern Texas: Johnson Griffith Lumber Co., 726 Brady building, San Antonio, Tex.
Middle West District: E. C. Coffin, Utah Savings & Trust building, Salt Lake City, Utah.
Chicago District: Joseph A. Rees, 3604 S. Morgan St., Chicago.
Canadian District: Jno. McCullough, 148 Jackson St. West, Hamilton, Ont.
Kansas City District: D. S. Rettig, R. A. Long building, Kansas City, Mo.
Cleveland District: J. C. Wicks, 311 Rockefeller building, Cleveland.
Northern Texas: Calkins & Patton, 308 Texas State Bank building, Fort Worth, Tex.
South Eastern District: W. P. Clark, Clark building, Lynchburg, Va.
New York District: W. C. Dickey, 521 W. Twenty-third street, New York City.
Middle South District: Jno. T. Everett, Memphis, Tenn.
Philadelphia District: Chas. E. McInnes, Land Title building, Philadelphia.
South Western District: J. V. Williams, 323 W. Washington street, Phoenix, Ariz.
Pittsburgh District: Fred Tod, Youngstown, O.

The New Haskell & Barker Car Co.

William E. Corey, chairman of the Midvale Steel & Ordnance Co.; Ambrose Monell, president of the International Nickel Co.; F. A. Vanderlip, president of the National City Bank, and Arthur Choate of the firm of Potter, Choate & Prentice, New York City, are among the directors of the reorganized Haskell & Barker Co., Michigan City, Ind., which has been purchased by a syndicate of New York bankers and capitalists. An offering of 220,000 shares of the reorganized company without par value, has been taken up largely by the promoters of the transaction. The ownership of the Haskell & Barker Car Co. was largely held by Mrs. Howard H. Spalding Jr., of Chicago, daughter of the late John H. Barker, founder of the company. The affairs of the company since Mr. Barker's death, in 1910, have been in the hands of three trustees, Jas. B. Forgan, president of the First National Bank of Chicago; E. K. Boisot and T. J. McBride. The company now has a reported capacity of about 20,000 cars a year and under the new management, is expected to be operated vigorously.

Will Make Grinders.—The La Salle Machine & Tool Co., La Salle, Ill., has taken over the line of American twist drill grinders formerly manufactured by the Heald Machinery Co., Worcester, Mass., including all the tools, patents, drawings and parts in stock.

Death of James E. Bullock

James E. Bullock, vice president and treasurer of the Illinois Malleable Co., Chicago, died Dec. 22. He was born at Otterville, Ont., Can., Jan. 21, 1844, and had he lived less than a month longer he would have attained 72 years. He had been a resident of Chicago for 25 years, going there from Canada to associate himself with his brother, Henry E. Bullock, founder and head of the company.

While in Canada, he was engaged in

JAMES E. BULLOCK

the lumber business and later assisted in building a railroad known as the Woodstock & Lake Erie railroad, from Port Dover to Wireton, Ont., which has been absorbed by the Grand Trunk railroad system. On the completion of that project, he went to Chicago and took charge of the inside work of the Illinois Malleable Co., which his brother was building up. He was also treasurer of the Bullock Tractor Co., also founded by Henry E. Bullock, the two concerns being closely affiliated. He was a member of the Chicago Club. He leaves his widow and one daughter, in addition to his brother with whom he was associated and another brother in Otterville.

The Oliver & Snyder Steel Co. is installing two Covington coke drawing machines at its plant at Oliver, Pa.

Large Orders

Placed by Shipbuilders—Corporation Advances to 1.85c, Pittsburgh

New York, Dec. 29. (By wire.)—Two ship builders have placed 10,000 tons of shapes and plates each with a large works for third quarter at 1.90c, Pittsburgh. The Steel Corporation is now quoting 1.85c, second quarter, and is taking heavy business at this figure.

The American Sheet & Tin Plate Co. takes 115,000 boxes of tin plate from a large oil company for next year's delivery at $3.75. Still higher prices in tin plate are expected.

The Southern railway has placed additional rail orders, 6,000 tons, to the Tennessee company and 5,000 to the Cambria Steel Co., making its week's awards 23,000. The Texas & Pacific places 7,000 tons with the Tennessee company and the Western Maryland 2,000 with the Carnegie Steel Co.

France, it is reported, has placed 2,000 cars with a Canadian car company. The Bessemer & Lake Erie will buy 2,000 ore cars and the Katy line is about to close for 1,500 to 2,000 cars.

Will Build at Cleveland

New York, Dec. 29. (By wire.)—The American Steel & Wire Co. will build 200 by-product coke ovens at its Newburgh works, Cleveland. The work probably will be done by the Corporation's own organization.

Moved to Pittsburgh.—The Railway & Industrial Engineering Co., Greensburg, Pa., manufacturer of switching and protective apparatus, and out-door sub-stations, has moved its sales office to the Peoples Bank Building, Pittsburgh. L. C. Hart, sales manager, has arranged at the new offices an exhibit of apparatus, in addition to a complete file of blue prints, photographs and data on the application of out-door equipment.

Large Additions.—An Attleboro, Mass., tool and stamping company has received an order for 1,500,000 rifle parts, which will cause it to make some large additions to its shop and clerical forces. The contract is with a foreign power.

Two men were killed and several were injured when an electric traveling crane toppled over in the chipping yard of the Pittsburgh Crucible Steel Co. at Midland, Pa., Dec. 22.

Record-Breaking Ore Sales

Are Made by Eastern Companies—Prices of Old Range Lake Ores Reduced Five Cents

New York, Dec. 28.—A record-breaking sales movement in eastern iron ores for 1916 delivery, now has been practically completed and it is estimated that these transactions call for a total of between 1,500,000 and 2,000,000 tons. This, by far, is the heaviest aggregate of ore business ever closed for a single year in the eastern market. Port Henry ore operators, who now are shipping at the rate of about 1,000,000 tons annually, will fill the larger portion of these contracts. Arrangements now are being made to materially increase the capacity of the Port Henry mines, to take care of this business. Witherbee-Sherman & Co., Inc., are opening new mines in the Barton Hill tract near Mineville and in the Sherman tract, about two miles from Mineville. The property of the Cheever Iron Ore Co. near Port Henry, which has been idle for more than a year, also is being placed in shape for early resumption. Other New York state and New Jersey mining companies are preparing for the largest year in their history during 1916. The new season's prices on iron ore, as previously stated, are on the basis of 8¼ to 9 cents per unit, delivered eastern Pennsylvania, for furnace material and at $4, at the mines for lump. Sellers of foreign ores still see small opportunity to compete with the domestic mineral in the eastern market, because of the high ocean freights. Wabana, Newfoundland, operators have indicated they might entertain some business on the basis of 11 cents per unit, Philadelphia, which is a prohibitive figure. The last previous sales of this ore in 1913 were on the basis of 7¼ cents per unit, Philadelphia.

Price Revision

Cleveland, Dec. 28.—During the holidays, there has been a lull in ore buying, following the very heavy buying of earlier weeks, but it is expected that the market will become livelier at an early date. A slight change in quotations has been made by reducing the price of old range ores 5 cents per ton, making old range bessemer $4.45 and old range non-bessemer $3.70, instead of $4.50 and $3.75, respectively, as quoted at the opening of the market. While large quantities of the ore were sold at $4.50 and $3.75, some sales were made at 5 cents less and sellers generally have agreed to conform to the lower prices which establish the differential of 15 cents between old range non-bessemer and Mesabi non-bessemer which prevailed prior to June 1 of this year. At that time, owing to the reduction in freight rates, the delivered price of Mesabi ores was reduced 5 cents per ton.

IRON ORE RECEIPTS AT LAKE ERIE PORTS, GROSS TONS.

	1915.	1914.	1913.	1912.	1911.	1910.
Toledo	1,158,374	773,711	1,084,215	1,411,278	493,345	1,225,202
Sandusky	.....	.....	.....	.....	.....	.....
Huron	60,833	617,363	687,485	540,586	223,947	197,951
Lorain	3,517,258	1,677,988	3,709,213	3,771,350	2,937,605	2,884,738
Cleveland	7,504,697	5,519,698	8,812,583	7,914,836	4,584,211	6,344,943
Fairport	2,001,103	1,558,134	2,037,126	1,810,381	666,365	1,516,434
Ashtabula	7,813,101	5,318,788	8,336,126	8,158,080	6,359,131	9,620,638
Conneaut	8,573,509	6,263,480	7,849,303	7,839,831	6,931,278	6,309,548
Erie	707,875	260,991	713,904	547,067	289,400	942,592
Buffalo	5,339,724	2,913,273	5,506,691	5,060,642	2,802,976	4,704,439
Detroit	459,877	332,564	363,001	418,057	243,292	296,412
Port Colborne	196,077	166,665	.....	.....	.....	.....
Total	37,332,428	25,402,655	39,099,647	37,472,108	25,531,550	34,042,897

IRON ORE ON LAKE ERIE DOCKS DEC. 1, GROSS TONS.

	1915.	1914.	1913.	1912.	1911.	1910.
Toledo	627,863	580,600	349,047	552,016	661,382	433,215
Sandusky	1,871	2,471	2,472	2,472	2,471	17,728
Huron	558,692	483,769	441,541	385,810	344,371	375,118
Lorain	824,988	548,097	694,704	904,343	652,526	630,547
Cleveland	1,670,962	1,757,543	1,930,720	1,888,560	1,589,491	1,638,795
Fairport	413,994	406,124	478,014	565,920	636,566	839,970
Ashtabula	2,870,204	2,749,315	3,202,807	3,350,553	3,295,862	3,287,816
Conneaut	1,216,686	1,160,639	1,248,032	1,429,533	1,237,573	1,329,997
Erie	589,355	484,467	594,613	661,330	636,274	792,011
Buffalo	326,800	234,880	319,726	340,261	413,353	452,783
Total	9,101,415	8,407,905	9,261,676	10,080,798	9,469,869	9,797,980

Ore Receipts and Ore on Dock

Statistics compiled by *The Marine Review* from the returns sent in by the various dock companies show that Lake Superior ore receipts at Lake Erie ports in 1915 were 37,332,428 gross tons, out of a total movement by lake of 46,318,804. On Lake Erie docks Dec. 1 there were 9,101,415 tons, the smallest tonnage for the past five years with the exception of 1914, when 8,407,905 tons remained on dock. The lake shipments, Lake Erie receipts and tonnage on dock for five years are shown as follows:

Year.	Lake shipments.	Lake Erie receipts.	On dock Dec. 1.
1915	46,318,804	37,332,428	9,101,415
1914	32,021,897	25,402,655	8,407,905
1913	49,070,478	39,099,647	9,261,676
1912	47,435,777	37,472,108	10,080,798
1911	32,130,411	25,531,550	9,469,869
1910	42,620,201	34,042,897	9,797,980

Shipments to furnaces between May 1 and Dec. 1 aggregate 34,323,316 tons, compared with 22,914,887 tons in 1914, 35,747,800 tons in 1913, 33,421,251 tons in 1912, 23,011,274 tons in 1911, and 29,724,938 tons in 1910.

The shipments to furnaces during the season of navigation as referred to are determined in this way: First, we have the amount of ore on Lake Erie docks as of May 1 last, 6,092,303 tons; add to this the receipts of the season just closed, 37,332,428 tons, the total is 43,424,731 tons; deduct the amount on dock Dec. 1, which is 9,101,415 tons, and we have 34,323,316 tons as the amount that was forwarded either direct or from dock to furnace yards.

It is understood, of course, that the difference between the total output of 46,318,804 tons shipped from the Lake Superior mines during 1915 and the receipts of 37,332,428 tons at Lake Erie ports is ore that went to places other than Lake Erie ports, such as furnaces at Lake Michigan ports.

The accompanying tables show receipts at Lake Erie ports and amounts on dock during the past six years.

Employes of Allis-Chalmers Mfg. Co., Milwaukee, Wis., who were subjected to a wage cut of 10 per cent early in the present year, including the office and similar forces, have been placed on full salary again, 5 per cent being added some months ago and the remaining 5 per cent recently. As a Christmas present from the company, each was given a check for the money involved in the reduction, with the good wishes of the company.

The Louisville Railway Co. recently disposed of its accumulated scrap to Louis P. Hyman & Co., Louisville old metal dealers, approximately 4,000 tons of material being involved. This was the company's scrap pile of several years. The amount paid was said to be between $12 and $15 a ton.

The Lima Steel Casting Co., Lima, O., is erecting an addition 80 x 160 feet, and is installing a converter to supplant the present crucible process.

(*For complete prices see page* 1302.)

Henry Wick's Death

Marks the Passing of a Strong Man of High Ideals

The death of Henry Wick at his home in Youngstown, O., Dec. 22, after a three days' illness with pneumonia has removed one of the most important figures in the establishment of the Mahoning and Shenango valleys as a steel-producing center. Previous to the construction of the bessemer steel works of the Ohio Steel Co., at Youngstown, the valleys had been distinguished entirely as a pig iron and bar iron producing locality.

Henry Wick was born May 13, 1846, son of Hugh B. and Lucretia (Winchell) Wick. Hugh B. Wick was a descendant of the original Henry Wick, who located in Youngstown in 1802. Hugh B. Wick, Mr. Wick's father, was not only a merchant but also a banker, being interested in the mining of coal shortly after its discovery in the Youngstown district and sharing in the establishment of the Youngstown Iron Co., the first rolling mill in the city. Henry Wick received a public school education and spent two years at Western Reserve college at Hudson, O. His first business enterprise was as manager of the Packard Coal Co., which opened a mine two miles west of Youngstown, but the mine proved unsuccessful. In 1877 he became treasurer and manager of the Youngstown Rolling Mill Co., which had built a plant in 1871 on the site of what is now the upper mill of the Carnegie Steel Co., and which then had acquired a reputation for the quality of its hoop iron. He retired from its management in 1888 and in the early 90's purchased an interest in the Warren and Girard mills, then united into the Trumbull Iron Co.

Up to this time, Youngstown had never had a steel plant. Its merchant blast furnace owners were content to sell their pig iron to mills at Pittsburgh, Wheeling and other steel producing centers from which the Mahoning valley mill owners purchased their billets and sheet bars. Thus the valley mill owners were compelled to pay the freight two ways and yet endeavor to compete with more nearly self-contained works outside the district. In the summer of 1892, Youngstown manufacturers determined to build a steel plant close at hand and formed the Ohio Steel Co. Mr. Wick was chosen its chief executive and W. H. Baldwin was its secretary and treasurer. First a capital stock of $600,000 was subscribed and works construction started. The capital was increased to $1,000,000, but before the plant was completed it had cost $1,500,000, and in its day was one of the best constructed and most economical steel works in the country. It was started in operation officially Feb. 4, 1895. Its subsequent success was phenomenal, this being largely due to the enthusiastic co-operation which the inspiring example of Mr. Wick aroused throughout his entire organization. The Ohio works especially was noted for the quality of sheet and tin plate bars which it turned out and for its thoroughly reliable methods of doing business. In 1898, the company undertook the erection of its own blast furnaces, beside acquiring a considerable reserve of iron ore.

In the beginning of 1899, the Ohio Steel Co. with several other plants joined in forming the National Steel Co., of which Mr. Wick became first vice president. In February, 1899, he removed to Chicago to the headquarters of the new company, becoming active in its management. A year later, the offices were removed to New York and early in 1901 Mr. Wick became president of the company. He resigned from this position, however, before the National Steel Co. was taken over by the United States Steel Corporation on its organization on April 1, 1901, preferring to return to Youngstown. About this time, he had taken a considerable interest in the Elyria Iron & Steel Co., with mills at Elyria, O., and with which his two sons, Hugh B. and Myron A., are connected, the first named as vice president of the company. He was interested in a number of Youngstown business enterprises, was a director in the General Fireproofing Co., president of the Elyria Iron & Steel Co., and president of a number of coal mining and miscellaneous enterprises, beside being a director in local banks.

HENRY WICK

Mr. Wick possessed high personal and business ideals up to which he lived strictly. He was an indefatigable worker, giving careful attention to details, but was thoroughly democratic and entirely untrammeled by the dignities usually associated with position and wealth. Energetic, fearless and keenly alert to the good which every civic movement might bring to his native city, Mr. Wick was always a leader in each movement making for civic righteousness in the city of Youngstown and he was entirely fair in his treatment of everyone. He was essentially a modest and reserved type of man, disliking the limelight of publicity, but entirely independent. His death was mourned by probably as wide an acquaintance throughout the iron and steel trade of the middle west as was possessed by any other citizen of Youngstown.

Mrs. Wick's death quickly followed that of her husband, also from pneumonia. She passed away Dec. 28.

Death of Chas. W. Davenport

Charles W. Davenport, vice president of the National Foundry Co., Erie, Pa., died at the Reed House in that city Dec. 20 from heart failure. Mr. Davenport had gone to the hotel to meet some friends and apparently was in good health, but suddenly lapsed into unconsciousness and died in a few minutes. The National Foundry Co. was organized in 1899 and Mr. Davenport was one of its organizers. It was his only business interest. He had been active in the Central Presbyterian church and in the Y. M. C. A. His father, William Davenport, was long an active figure in industrial affairs in Erie.

Samuel Diescher, 76 years old, a prominent engineer of Pittsburgh, died Dec. 24 at his home in that city. He was born in Budapest and came to America in 1858. He went to Pittsburgh in 1870 and was employed in the city engineer's office for a number of years. Subsequently he was chosen city engineer. He was in charge of the building of two inclines on the South Side, and was identified with street railway and steel plant construction work until a few years ago. In 1902, he organized the firm of Samuel Diescher & Sons, engineers.

Naylor & Co., 120 Broadway, New York, have opened a Philadelphia office at 1527 Real Estate Trust building, in charge of Laird U. Park, for the handling of pig iron, alloys and steel.

MEN OF THE IRON TRADE

Who they are **Where they are** **What they are doing**

W. S. Pilling, of Pilling & Crane, Philadelphia, has been continued as secretary of the Eastern Pig Iron Association for the year 1916.

J. H. Plummer, president of the Dominion Steel Corporation, who had been ill for some time has recovered sufficiently to attend to business.

Col. Frederick Nichols, president of the Canadian General Electric Co., who has been for some weeks in England, has returned to Toronto.

Howard E. Shelton, of the Shelton Foundry Co., was elected treasurer of the Paducah, Ky., Manufacturers' Association, which recently held its annual meeting.

Col. Thomas Cantley, president of the Nova Scotia Steel & Coal Co., will shortly leave for England for a rest and will probably be absent for about six months.

G. H. Lewis has been elected president of the Westinghouse Club to succeed A. D. Hart. Members of the club are employes of the Westinghouse interests at Pittsburgh.

T. H. Hermanson has resigned from the Epping-Carpenter Pump Co., Pittsburgh, to become superintendent of the Blake & Knowles Steam Pump Works, Cambridge, Mass.

George I. Rockwood, president of the Rockwood Sprinkler Co., of Massachusetts, Worcester, Mass., has been selected a trustee of the Worcester Polytechnic institute.

J. H. Himes, general manager of the Carnahan Tin Plate & Sheet Co., Canton, O., will leave about Jan. 1 for a six months' trip through South America, accompanied by Mrs. Himes.

E. T. Causer, for nearly four years factory superintendent of the Mitchell-Lewis Motor Co., Racine, Wis., has resigned to accept the position of works manager for the R. D. Nuttall Co., Pittsburgh.

Frank H. Johnson, general manager of the West Leechburg Steel Co., Pittsburgh, has resigned to inaugurate a sales service in iron and steel specialties with headquarters in Chicago.

Chas. B. Ellis, who recently has been connected with the Bartlett Hayward Co., Baltimore, has rejoined the New York staff of the American Vanadium Co., Equitable building, New York City.

James W. Hitchcock, assistant general manager of sales of the Phillips Sheet & Tin Plate Co., Weirton, W. Va., has decided to retire from the tin plate business and has resigned his position, effective Dec. 31.

J. P. Barrow has been succeeded as head of the publicity department of the Youngstown Sheet & Tube Co., Youngstown, by R. J. Kaylor. Mr. Barrow will assume duties in the operating department of the company.

C. A. Bryan, who has been assistant traffic manager of the Republic Iron & Steel Co. in the southern district, has been made traffic manager, with headquarters at 1706 Woodword building, Birmingham, succeeding W. H. Johnston, recently deceased.

Dr. H. E. Horton, of the Chicago office of the American Steel & Wire Co., will speak on "From the Furnace to the Farm", at a noon day luncheon of the Worcester, Mass., chamber of commerce in the Bancroft Hotel, that city, Jan. 5.

Persifor Frazier, of Philadelphia, has retired as vice president of the Harlan & Hollingsworth Corporation, Wilmington, Del., and has been succeeded to that office by Samuel K. Smith, former treasurer. Henderson Weir takes Mr. Frazier's place as a director.

A. E. Borie, president of the Driggs-Seabury Ordnance Co., Sharon, Pa., has been elected president of the Savage Arms Co., which has been taken over by the former company. Mr. Borie, E. C. Delafield and Jas. Imbrie have been elected directors of the Savage Arms Co.

George M. Funnell, who for the past six months has been factory manager of the American Graphophone Co., Bridgeport, Ct., has resigned that position and sailed from New York, Dec. 23, for London, Eng., where he will reside as representative of the company for Great Britain.

Benjamin O. Anderson, who has been manager for the Hendee Mfg. Co., in San Francisco for the past five years has returned to his former home in Portland, Ct., and will soon go to Springfield, Mass., to take up the work in the main factory of the company as the office in the west has been closed.

Samuel W. Traylor, president of the Traylor Engineering & Mfg. Co., Allentown, Pa., has been made manager of the ordnance department of the plant of the Crucible Steel Co. of America at Harrison, N. J. Mr. Traylor will not relinquish his present post with the Traylor Engineering & Mfg. Co.

Andrew J. Sloper, New Britain, Ct., has resigned as secretary of the American Hardware Corporation and is succeeded by George T. Kimball. Mr. Sloper, whose advice has been frequently followed in shaping the policy of the corporation, will remain as a director. He was one of the prime movers in forming the present hardware corporation, representing the Russell & Erwin interests in bringing about the merger.

F. Peiter has severed his connection as coke oven engineer of the Gas Machinery Co., Cleveland. For the past three years, Mr. Peiter has been engaged in the designing and development of the gas machinery top burner regenerative coke oven. Previous to his association with the Gas Machinery Co. he was connected with the H. Kopper Co. as designing and constructing engineer and was with the Tennessee Coal, Iron & Railroad Co. during the designing and construction of its Fairfield, Ala., coke oven plant. Mr. Peiter has several connections in view, but will take a short rest before assuming other responsibilities.

Stop Scrap Exports

Toronto, Dec. 28. — By an order in council, issued Dec. 20, the Canadian government has prohibited the exportation of scrap steel and scrap wrought iron to ports other than those of the British Empire.

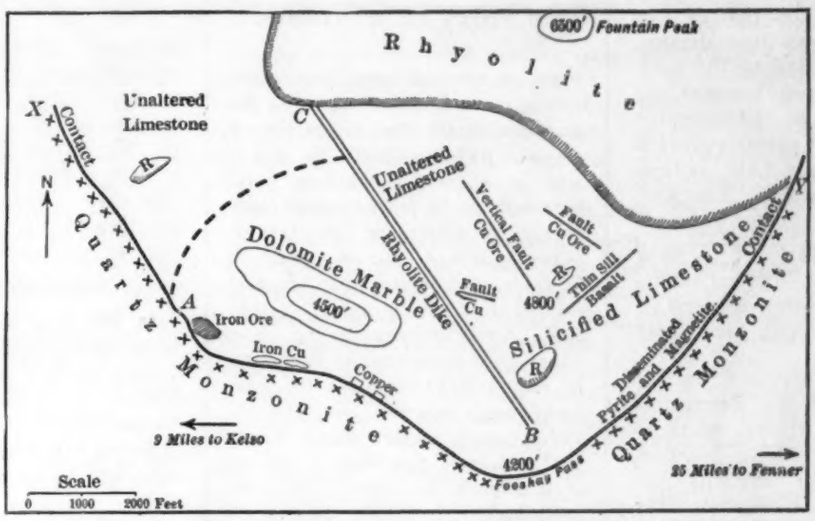
New Engineering Company. — The Poland-Miller Co. has been organized by J. F. Poland and R. E. Miller, to conduct a general engineering business, specializing in the design and inspection of coal, coke and ore-handling machinery, docks and industrial plants. Mr. Poland was formerly employed as a civil and structural engineer with the Brown Hoisting Machinery Co., also the J. W. Frazier Co., and Mr. Miller as a mechanical and electrical engineer with the J. W. Frazier Co. The offices of the new company will be in the Erie building, Cleveland.

The Pacific Coast Iron Situation

ALTHOUGH mining and smelting operations have thus far made comparatively small progress on the Pacific coast, the possibilities as revealed by numerous surveys appear excellent for the development of the industry. Large surface deposits of ore exist in California, while Alaska, Washington and southern Utah possess suitable coking coals, the latter being the most available. Climatic conditions are also favorable.

By Charles C. Jones

IN ANY discussion of the iron ores of the Pacific coast we are confronted at the outset with so many obstacles that at best only a fragmentary and rather disconnected presentation can be made, and my hope is that building from the few facts I have to offer a more complete knowledge may be secured. In the whole intermountain and Pacific coast region, west of Pueblo, Col., and from Canada to Mexico, there is no production of pig iron, and steel production is confined to the manufacture of a small amount of open hearth steel from scrap. When we consider the area, the resources and the several centers of population, this condition seems anomalous, even in the face of every counter argument as to cheap water transportation, or other means of transport from the Atlantic seaboard or from the iron and steel centers of the middle west.



SKETCH MAP SHOWING GEOLOGICAL CONDITIONS IN EASTERN SAN BERNARDINO COUNTY IRON ORE DISTRICT

This comatose condition, if such a term may be applied, is certainly not due to a lack of all the essential materials and factors for success in iron and steel smelting, but is rather, I think, due largely to the general fact that it is only within a comparatively few years that the centers of population on the Pacific coast have attained a size that would entitle them to the position of distributing or freight centers, or that the "back country" has been enough built up to make it sufficiently interesting to the railroads to foster trade from the local centers to the interior points rather than seek to supply such local centers and the interior by a transcontinental haul.

Mr. Edwin C. Eckel, in his monumental work on Iron Ores, has but little to say concerning the Pacific coast deposits. He mentions those of Minaret, Madua county, and the Eagle Mountains, Riverside county, Cal., "perhaps 50 to 100 million tons each"; the deposits in Shasta county, worked for the electric furnace on Pitt River; and "ores in Oregon and Washington", which "have been slightly developed"; and while he admits that by reason of unfavorable conditions, as to labor and fuel, for the manufacture of iron, there has been comparatively little prospecting for iron ores in the Pacific states, he thinks that certain geological types of iron-ore deposits, which have been highly productive in the east, are probably wanting here—for instance, sedimentary beds like the Clinton, and brown-ore deposits like those of the Appalachian region. And in his final summary of American iron ore resources he cites Hayes' estimate of 126,000,000 tons of available ore "for the Rocky Mountain and Pacific states"; pronounces it too low, since Utah alone contains more; and finally puts down the western states for a minimum of 300,000,000 and a possible maximum of 700,000,000 tons. His estimate for the whole United States being 5,200,000,000 minimum and 7,500,000,000 maximum, the proportion assigned to the great area between the Rocky mountains and the Pacific is notably small.

Mr. Eckel does not cite in his Bibliography of California deposits, *Bulletin* 503, *U. S. Geological Survey*, by E. C. Harder, on Iron Deposits of the Eagle Mountains, published in 1912. In the light of the Harder report on the Eagle Mountains and other data, I think the Eckel estimate of from 300,000,000 to 700,000,000 tons can be safely applied to the Pacific states alone, excluding the tonnages of Utah and the other Rocky Mountain states; and, from the present knowledge, most of it is in Southern California. At the annual meeting of the American Mining Congress, held in Los Angeles in 1910, the writer, in an address on the subject of iron ores of the southwest, called attention to the large available deposits of high grade iron ore in southern California and adjacent territory, and previously in the *Engineering and Mining Journal* of April 17, 1909, had described technically the iron deposits in the Providence Mountains of San Bernardino county, Cal. The U. S. geological survey published in 1908, Bulletin No. 338 on The Iron Ores of the Iron Springs District, Southern Utah, and in 1912, Bulletin No. 503, Iron Deposits of the Eagle Mountains, California. Descriptions of various other iron deposits are scattered through technical publications. Epitomizing the subject in 1910, I came to the conclusion that there are 200,000,000 tons of available, high grade iron ore and double that amount of probable ore in southern California. In addition to this an equal amount can be counted on from Lower California and

A paper presented at the San Francisco meeting of the American Institute of Mining Engineers, September, 1915.

Mexico, which will naturally seek an outlet to the northward. This estimate does not include the Utah deposits. In 1908 and 1909, the late Edward H. Harriman acquired the Eagle Mountain iron deposits, in Riverside county, 50 miles north of Mecca, a station on the Southern Pacific railroad, 140 miles east of Los Angeles, with the publicly avowed intention of establishing a steel works at Los Angeles. The United States geological survey states as a "moderate estimate" that there are 60,000,000 tons of iron ore in this deposit. Later, what is known as the Cave canyon iron deposit, 200 miles east of Los Angeles on the Salt Lake railway, containing 20,000,000 tons, was bought by the same interests. The untimely death of Mr. Harriman in 1909 put a damper on further development, and his vision is yet to be realized.

Near Kelso, 236 miles east of Los Angeles, is the Vulcan iron deposit, containing from 6,000,000 to 10,000,000 tons of high grade, soft hematite ore of bessemer grade. In the Kingston Mountains at the California-Nevada line, north of the Salt Lake railway are other large deposits. The Colorado Fuel & Iron Co. owns a deposit of 12,000,000 tons 10 miles west of Silver Lake on the Tonopah & Tidewater railway.

Desert Iron Deposits

There are large amounts on the Santa Fe railway in San Bernardino county south of Newberry, north of Amboy and south of Blythe Junction, and numerous other deposits are known in the desert region. The three most practically available deposits, viz.: the Eagle mountain, Cave canyon, and Providence mountain deposits, represent an aggregate tonnage of 125,000,000 tons, and have the characteristics necessary to the best possible furnace mixture for economical smelting. These ores run from 4 to 10 per cent higher than standard Lake Superior iron ores. The bulk of the tonnage is within the bessemer limit in phosphorus and, lacking moisture, there is no cost of drying before transportation, or freight cost on 10 per cent of moisture as with Lake ores. Bulletin No. 503, on Iron Ore Deposits of Eagle Mountain, California, is authority for these statements. The average analysis of Providence mountain iron ore is: Iron, 64.82; phosphorus, 0.044; silica, 3.04; manganese, 0.278; alumina, 0.568; magnesia, 0.201; lime, 0.444; sulphur, 0.059; titanium none; volatile, 1.85 per cent.

According to one of the leading buyers of iron and steel, the following is a conservative estimate of the present approximate yearly consumption on the Pacific coast:

	Tons.
Pig iron	100,000
Reinforcing steel for concrete buildings	30,000
Sheets	136,000
Plates	217,000
Corrugated	15,000
Bar	175,000
Structural	250,000
	923,000

Probably the aggregate is more nearly double this estimate. Complete figures would include the large amounts of cast iron water pipe, oil well pipe, railroad steel and other steel products not listed above.

At some future time there will certainly be one iron smelting center in southern California; and there may possibly be a second at San Francisco and a third at Seattle, each having its own distinct province from which to draw its supplies of raw materials; but at the present time southern California seems to have the advantage in the combination of ore, fuel, labor and climatic conditions for economical production.

The Story in a Nutshell

At the present time the entire Pacific coast is dependent upon the east and south for its supply of pig iron and steel, with the exception of a small amount of steel produced largely from scrap at Seattle, San Francisco and Los Angeles.

Simply stated, pig iron can be made in the regular blast furnace way at Los Angeles for less than $14. *No Pennsylvania pig iron, either by transcontinental freight or by rail to New York and via Panama canal, can be put into the Pacific coast market under* $19 *a ton. Alabama pig might be put in at a slightly less cost. The consumption of iron and steel products on the Pacific coast is conservatively estimated at* 923,000 *tons per year.*

The statement that conditions justify the establishment of at least one plant, based on the consumption of iron and steel products on the Pacific coast will be borne out, if it can be shown that these products can be manufactured locally at a price to compete with the supply from other smelting centers.

In the following discussion some of the figures relating to Pittsburgh are used as given in a recent publication by the Merchants' Association of New York on the iron and steel industry, supplemented by personal knowledge, and figures from *Mineral Resources of the United States,* 1913, published by the United States geological survey, and also figures from the report of the commissioner of corporations on the steel industry, 1911, and costs of making pig iron from testimony before the ways and means committee of the house of representatives in 1906. Pittsburgh is the center of the iron and steel industry in the United States and any costs on the Pacific coast that can be shown to approximate Pittsburgh costs will demonstrate not only the feasibility of the industry, but the certainty of profits.

The difference in mining and transportation costs between Lake Superior ores and California ores is due to a number of reasons, principal among which are the following: The Lake Superior ores are obtained either by expensive underground mining or by open-cut work in which large amounts of overburden have to be removed at considerable cost; and, on account of climatic conditions, the shipping season is limited to seven months of the year. Transportation is a combination of rail, water and rail, entailing several handlings of the ore.

Advantages of Western Mining

In the case of California ores, we have large surface exposures of ore bodies, capable of being quarried and loaded on cars by steam shovel, and handled thence direct to the furnaces. The mining cost of California iron ores will be on the same low basis as that of porphyry copper ores, or from 20 to 30 cents per ton. The figure of 85 cents in the following estimate is ample to cover both royalty, or sinking fund, and mining. Climatic conditions are such that work can be carried on every day in the year with the exception possibly of a few stormy days; and California ores have the added advantage of a higher content in iron and a lower amount of gangue to be fluxed, resulting in greater efficiency, or tonnage product of a furnace and decreased cost of flux, per ton of iron produced, all of which factors materially lower the operating cost per ton of pig iron produced.

Comparing the bessemer ores alone, as the bulk of the California ore is of that quality, the advantage of Los Angeles over Pittsburgh, in cost of iron ore per ton of pig iron is $4.86. The average mining cost for Lake Superior ores is taken from *Mineral Resources of the United States,* 1913, U. S. geological survey, and is exclusive of any transportation costs. Of equal importance to the iron

ore is a supply of suitable coal for coking. There are probably good coking coals in Alaska and Washington that could be placed in the Los Angeles market at a reasonable price; where a number of chemical industries could follow the establishment of a by-product coke plant, utilizing the tar, ammonia and gas by-products. The building of the Alaska railroad into the Matanuska coal field by the government will open that coal to southern California; and, if the claims regarding its coking qualities are substantiated, it will afford a supply of coking coal cheaper than from any other section.

Table I.

COMPARISON OF COSTS OF IRON ORE AND TRANSPORTATION AT PITTSBURGH AND LOS ANGELES

	Pittsburgh Lake Superior ores.	Los Angeles California ores. Assuming max. haul 260 miles at 0.005c.
Rail and Lake rate to Lower Lake Ports	$1.15	.....
Rail freight rate, Lower Lake Ports to Furnace location	0.88	.....
Rail freight rate, Eagle Mountains, Providence Mountains, and San Bernardino County ores	....	$1.30
Total transportation, costs per ton	2.03	1.30
Average mining cost per ton	2.40	0.85
Total transportation and mining cost per ton	4.43	2.15
Percentage iron yield per ton ore, non-bess. grade, per cent.	51.5	57.00
Percentage iron yield per ton ore, bessemer grade, per cent.	55.0	64.00
Total transportation and mining cost per ton pig iron, 95 units iron, non-bessemer grade	$8.17	$3.56
Total transportation and mining cost per ton pig iron, bessemer grade	8.05	3.19

and there are large coal fields in southern Utah at present without railway connection, undoubtedly containing coking coals; but at the present time the coking coal of Carbon county, Utah, is the most available by reason of rail connection. The Carbon county, Utah, coal, at Sunnyside in the Book Cliffs coal field, compares favorably in coking and chemical qualities with some of the eastern coals and a comparison of costs on that basis will be made.

An average analysis of Sunnyside coal and coke is as follows:

	Coal, per cent.	Coke, per cent.
Moisture	1.27	0.13
Volatile matter	39.13	0.83
Fixed carbon	54.62	88.96
Ash	4.98	10.07
	100.00	99.99

The metallurgical coke for the Utah and Montana copper smelters is supplied from Sunnyside field and its good qualities are thoroughly proved. A description of the Book Cliffs coal field was given by Robert S. Lewis.

In the report of the commissioner of corporations on steel industry, 1911, the cost of coke at Pittsburgh has been shown to be $2.97 per ton of pig iron, and from that cost it is estimated that the cost of by-product coke provided a profitable market for the by-products could be secured at Pittsburgh, would be $1.94 per ton of pig iron. The above figure of $2.97 is borne out by the current quotations on Connellsville coke, May 1, 1915. As compared with the cost of by-product coke at Pittsburgh, the costs of production are moderate in Los Angeles, where a ready market could be found for the by-products and can be shown to be less than that of by-product coke.

I should observe that my estimates are made on a rational freight rate of 0.5-cent per ton-mile. The present published rates on coal and coke from the interior are higher than that, being still based on "all the traffic will bear"; and, since the amount handled is small, no attempt has been made to secure a lower rate. That the 0.5-cent per ton-mile is a reasonable maximum is shown by the fact that that rate is in existence for phosphate rock and other material, of a like or higher value than coal, from the intermountain region to tidewater. I mention this matter because it is one of the "scarecrow arguments" that have to be met. When the traffic justifies it, the rate can be secured, through the usual channels.

Limestone Supply

Available to every railroad entering Los Angeles, at distances of from 20 to 150 miles are ample deposits of limestone suitable for blast-furnace flux. This rock can be quarried and brought to tidewater at as low a price as that used in Pittsburgh, and from many of the deposits for a less cost. Even at a greater cost per ton of limestone, the cost per ton of pig iron would still be as low as the Pittsburgh cost on account of the greater purity of the iron ores and consequent smaller amount of lime used for flux. In my estimate of final costs, the Pittsburgh figure will be applied as fully covering the limestone cost.

An application of the above figures and a comparison of the cost of pig iron at Pittsburgh with the estimated cost at Los Angeles will be of interest in this connection.

In 1906, before the ways and means committee of the house of representatives, Judge Gary testified that for all the furnaces of the United States Steel Corporation the total cost of making a ton of pig iron, based on the market prices of iron ores, coke,

Table II.

COST OF COKE AT LOS ANGELES OR SOUTHERN CALIFORNIA POINTS

Mining cost 1.65 tons Utah coal at 90c per ton		$1.48
Transportation 1.65 tons at $4.25, 850 miles at 0.5c		7.01
Total cost coking and byproduct operation per ton coke		1.40
		$9.89
Credit from sale of byproducts per ton coke, 8,000 cu. ft. gas at 15c.	$1.20	
14 gal. tar at 4c	0.56	
24 lb. sulphate ammonia at 3½c	0.84	2.60
Net cost of coke per ton		$7.29
Total cost of coke per ton of pig iron (1.10 tons per ton pig)		8.02
Cost byproduct coke Pittsburgh minimum		1.94
Maximum advantage of Pittsburgh in cost of coke per ton of pig iron		$6.08
Total cost of coke per ton of pig iron (1.10 tons per ton pig)	8.02	
Or at average cost of coke	2.97	
Average advantage of Pittsburgh in cost of coke per ton of pig iron.	$5.05	

limestone, cinder and scale, and including maintenance and depreciation of furnaces, was $15.30 per ton of pig iron, divided as follows:

Iron ore per ton $4.70, per ton pig iron	$8.62
Coke per ton $3.93, per ton pig iron..	4.15
Limestone $1.06, per ton pig iron.....	0.49
Scrap, cinder and scale.....	0.27
Labor and maintenance	1.37
Depreciation of furnaces.....	0.40
	$15.30

From these figures he said the following deductions should be made for net profits:

On ores in pig iron.....	$2.04	
On coke in pig iron.....	0.60	
On transportation	1.07	$3.71
Actual cost of pig iron.....		$11.59

Assuming other costs than the ore, coke and flux to be the same at Los Angeles and Pittsburgh, we have the following as a conservative statement of the estimated cost of a ton of pig iron at Los Angeles, or tidewater:

Total transportation and mining cost per ton pig iron, bessemer grade ore	$3.19
Total cost of coke per ton pig iron...	8.02
Limestone	0.49
Scrap, cinder and scale.....	0.27
Labor and maintenance at furnaces....	1.37
Depreciation of furnaces.....	0.40
	$13.74

In Mineral Resources, 1913, Part 1, p. 321, the government gives as the average price per ton of pig iron at the Pennsylvania blast furnaces for 1913	$15.36
And for Alabama furnaces.....	12.08

Accepting for the purposes of this discussion the figures given by Mr. Gary for $11.59 as the net cost of pig iron for all the furnaces of the United States Steel Corporation in the year 1906, and deducting it from the estimated cost at Los Angeles of $13.74, we have a difference of $2.15 per ton in favor of Pittsburgh, but the railroad freight rate on pig iron from Pittsburgh makes the net cost of pig iron at least $20.95 f. o. b. Los Angeles and selling price $23 to $25 per ton.

In regard to freight rates on pig iron and steel products to Pacific coast points, the published rate from Chicago and Birmingham is $9 per ton, and as there is no through rate from the Pittsburgh district, the total freight from that point is $12.15 per ton to California terminal points. Steel products have a uniform freight rate of $16 per ton, Pittsburgh to coast points. In my calculations an average freight rate of $9 has been used, being the rate from Chicago or Birmingham to coast points.

Markets and the Cost of Reaching Them

At the present time the entire Pacific coast is dependent upon the east and south for its supply of pig iron and steel, with the exception of a small amoun of open hearth and electric steel produced from scrap at Seattle, San Francisco and Los Angeles. As our principal market, we have this Pacific coast province, comprising the states of California, Oregon and Washington, which can only be reached by the eastern manufacturer after paying a minimum transcontinental freight of $9 per ton, or a minimum water freight from Atlantic ports of $6 per ton.

Los Angeles is the great lumber market of the Pacific coast, and most of the vessels in the trade are without cargo on the return trip and would welcome the opportunity to carry iron and steel products to San Francisco, Portland, Seattle and Vancouver at low water-rates. The markets of South America are open on more than equal terms; for tonnage through the Panama canal from the Atlantic seaboard to the west coast of Mexico and Central and South America must pay the toll of $1.20 per ton.

Simply stated, pig iron can be made in the regular blast furnace way at Los Angeles for less than $14. No Pennsylvania pig iron, either by transcontinental freight or by rail to New York and via Panama canal, can be put into this market under $19 per ton. Alabama pig might be put in at a slightly less cost, but its quality would not place it in the same class as pig iron made from California ores.

Geology of the Ore Deposits

The principal southern California iron deposits are of the contact-replacement type formed at or near the contact of an intrusive igneous mass with sedimentary strata, usually limestones. The Providence mountains of eastern San Bernardino county present the greatest uplift and cross-section of strata found between the Grand canyon of the Colorado in northern Arizona and the Sierra Madre range in western San Bernardino county, and afford an opportunity to study a section approximately 4,000 feet thick, from the underlying granitic and schistose rocks up through a sedimentary series predominantly composed of limestones with subordinate beds of shale and quartzite. This has been brought to the attention of the United States geological survey; and I believe an extended study of the region will fill several gaps in our knowledge of the geology of this part of the desert region.

The general strike of the sedimentary beds is northeast-southwest with a slight dip to the east. The central core of the mountain, exposed in canyon from base to top, and forming the highest peaks, is a core or plug of rhyolite, a mile or more in diameter. At the southwest end of the mountain the sedimentary beds, lying horizontal or dipping slightly to the east, and retaining this position undisturbed, have been cut by a large quartz-monzonite mass, the contact between the monzonite and the limestones being practically vertical. I have indicated on the accompanying sketch map the general conditions.

In the sketch map, I have indicated conditions nine miles southeast of Kelso; *R* is the central core of this part of the Providence mountains, composed of rhyolite and detached small rhyolite exposures are shown at several places in the limestones marked *R*. *XY* is the line of contact between the sedimentary series and the quartz-monzonite mass.

The contact of the monzonite, cutting sharply the practically horizontal beds of limestone, runs for a distance of about four miles; *BC* is a vertical dike of rhyolite porphyry, 100 feet thick, an offshoot from the central core. The point marked *A* seems to have been the center of activity, resulting in a replacement of the limestone by iron, over an area of four acres, with smaller ore bodies along the contact to the east and with a great dissemination of grains and irregular replacements of iron ore in the limestones. The original bedding planes of the limestone are still preserved in the beds of iron ore; and in the area *ABC* the limestones have largely lost their bedded structure and a mass of crystalline dolomite or dolomitic marble has resulted. The end of the dike *BC* is not seen in actual contact with the monzonite at *B*. To the west of dike *BC* is an area of dolomite, as indicated, of the following analysis:

	Per cent.
Insoluble siliceous material....	0.43
Aluminum and iron oxides....	0.24
Calcium carbonate	63.08
Magnesium carbonate	35.97
	99.72

To the east of dike *BC* is an area of limestones between the rhyolite and monzonite, a portion of which is seemingly unaltered, especially just east of point *C*, where, in contrast with the dolomite west of the dike, the blue unaltered limestones preserve perfectly their bedded structure, and the larger portion of the area, especially at and for several hundred feet north of the contact, is largely silicified. An analysis of a typical sample shows:

	Per cent.
Silica	48.0
Lime	25.8
Iron-oxide	4.3
Alumina	12.9
Carbonic acid	5.0
Undetermined	4.0
	100.0

Much analytical work is needed to determine the composition of the

(*Continued on page* 1302b.)

Recommends Uniform Cost System

AN ADMIRABLE system designed to simplify methods of accounting foundry costs, has been evolved by a committee of the American Foundrymen's Association. It is based on the facts that the commodity sold by a foundry is labor and not material, the latter varying with market conditions; that the cost of production varies as the output of the individual molder; and that the overhead costs vary in a similar manner.

IN PRESENTING the accompanying suggestions it is assumed that practically every casting manufacturer has a cost system of some kind. These systems vary as widely as the number of cost experts or accountants by whom they are installed; and due to this lack of uniformity in systems, theories or bases from which they arrive at the costs, the chaotic conditions of the foundry industry today are attributable. It is evident, therefore, that the essential feature in the elimination of existing conditions is the adoption of a uniform basis or theory which should underlie all cost systems for the computation of foundry operations. In other words, the adoption of a cost system is not recommended, but rather the adoption of a uniform basis of figuring costs. The factors or theories constituting this uniform basis follow:

1.—The commodity sold by a foundry is the labor of the molder and coremaker and not the material entering into the product.

2.—The material is more or less of a constant, varying with market conditions.

3.—Cost of production fluctuates in proportion to pounds of output per molder.

4.—Overhead charges increase or decrease according to pounds of output per molder.

Discussing factor No. 1, what is the merchandise or commodity sold by a foundry? In the last analysis, is it not the product or the labor of one, 10 or 100 molders? Is it not what they really produce and not what the furnace produces Now referring to factor No. 2, material is subdivided into two classes: (*a*) Material such as pig iron, scrap, coke, gas, etc., directly chargeable to melting, and (*b*) sand, flour, molasses, emery wheels, core binders, nails, chaplets, etc., are chargeable to other departments as a direct expense. Factor No. 3 is controlled by slow-moving and rapid-moving jobs. These phrases have been coined to differentiate between small tonnage per molder and large tonnage per molder. Factor No. 4 is not a constant, but is a variable paralleling No. 3, overhead charges increasing with slow-moving jobs and decreasing with fast-moving jobs.

It is evident that competing foundries in the same locality have approximately the same costs for material, labor, production (depending upon management and equipment), sales and clerical assistance, rent, interest, taxes and insurance. But they do not follow the same method of computing or grouping the foregoing. It is not difficult to ascertain accurately the total monthly and annual costs of metals, materials, labor and overhead charges. It follows then that four fundamental requirements must be considered: Accurate payroll distribution; accurate stores accounting (material disbursements, covering only the month's actual consumption—not receipts); accurate bookkeeping and accurate accounting of production in net tons of good castings to ascertain the proper divisor for all amounts obtained from the foregoing.

The problem of greatest difficulty is to find the proper differential of overhead costs, or rather the proper method of distributing the overhead to the various departments and patterns. It will be conceded that a different overhead is to be applied to almost each and every job and briefly stated, a fast-moving job should not bear as great an overhead as one that is slow-moving.

What is the standard basis or key for such different jobs?

This has proved a stumbling block to many foundrymen and accountants, as it is difficult to get them in agreement on this point.

Many ways in which the overhead charges are figured might be mentioned, but we wish to emphasize that we are endeavoring to recommend a system which first will appeal to the manager, superintendent or foreman, realizing that the expert accountant may criticize the recommendation in not having carried it out in further detail. To obtain the hearty co-operation of all of the heads of the departments to insure the satisfactory operation of a cost system, it should be simple and not too greatly involved. We have endeavored to find not necessarily the most perfect system, but the simplest one which can be applied most easily by the greatest number of foundrymen. Therefore, it has been decided to recommend what might be termed "the-tonnage-per-day-per-man-plan."

In recommending this plan it is realized that many will take issue with it. Some may inquire about weight and while this point is acknowledged as well taken, it is not advisable to become

Production 500 Tons

		Metal		Materials		Labor		Total	
		Total	Per Ton	Total	Per Ton	Total	Per Ton	Total	Per Ton
	1. Melting	$850.00	$1.70	$1000.00	$2.00	$1300.00	$2.60	$1080.00	$2.16
	2. Molding and Cores			1375.00	2.75	(Direct 500.00 Ind. 250.00 Over 400.00) 1000 150 250		827.50	1.725
	3. Cleaning			1000.00	2.00			500.00	1.00
Manufacturing Overheads	a. Producing Total	850.00	1.70	3375.00	6.75	1290.00	2.58	2467.50	4.935
	4. Pattern			150.00	.30	225.00	.45	375.00	.75
	5. Flasks			275.00	.55	100.00	.20	375.00	.75
	6. Power, Light, Heat			580.00	1.10	250.00	.50	830.00	1.60
	7. Repairs, Maintenance			265.00	.50	400.00	.80	665.00	1.33
	8. Yard			260.00	.50	400.00	.80	425.00	.85
Executive Overheads	b. Manufacturing Total	850.00	1.70	4440.00	9.25	1417.50	2.835	2731.50	5.463
	9. Rent Account			600.00	1.20				1.20
	10. Administration			1000.00	2.00	2050.00	4.10	3050.00	6.10
	11. Sales			1000.00	2.00	3250.00	6.50	4250.00	8.50
Other Overheads	12. Extraordinary Charges			400.00	.80	600.00	1.20	1000.00	2.00
	c. Total Cost	$850.00	$1.70	$6740.00	$13.48	$17150.00	$34.30	$32390.00	$64.78
	13. Returned Castings							260.00	.52
	d. Grand Total							$32650.00	$65.30

FORM FOR ASCERTAINING ANNUAL OR MONTHLY OPERATING COST

From the report of the cost committee of the American Foundrymen's Association, presented at the twentieth meeting, Atlantic City, N. J., Sept. 28-Oct. 1, 1915.

too scientific at the beginning, as the plan can be further refined. What is required is a simple theory to begin with, one that any manager, superintendent, foreman or molder can comprehend fully and not one that is merely understandable by an expert and an accountant. One reason for adopting what might be termed "the-tonnage-per-man-plan" is that almost every foundry can turn to its past records for a year or several years and establish an average per day per man that has been molded for this period. Also, the number of molders' hours for a similar period can be ascertained. Then ascertain if the average man produces 100, 500, 1,000 pounds per day, or whatever amount this may be, and the standard of the plant thus is secured to start with. It will not be difficult to obtain the total amount of expenses or overhead charges for the same period as covered by the tonnage per man, as almost any system of bookkeeping will show this. Divide this total by the total tonnage produced during this same period and the average overhead expense per ton or per pound, as well as the average production per molder, will thus be obtained.

The overhead is based entirely on the labor of the molder and coremaker, eliminating cleaning room labor, etc., which might be included, but which will not be taken into consideration at this time as cleaning costs, etc., will be taken care of subsequently.

It will be assumed that two standards have been obtained, namely, the tonnage or pounds per man and the overhead per pound. Suppose that the tonnage per molder per day, or the average output per day per man, is 500 pounds and that the overhead expense per ton is $10, or ½ cent per pound. If the job is of the average molding type, one which can be produced at the average of 500 pounds, the average cost applies. If, on the other hand, the job is light weight, difficult or slow to mold and only 250 pounds is obtained per day, the overhead would be about twice as much as when the output was 500 pounds, or the equivalent of $20 per ton, or 1 cent per pound in place of the standard or average of ½ cent per pound. It then is necessary to add to the average cost not only the cost of extra molding, but the ½ cent additional overhead cost. It is apparent that if the foundry is operated on this slow-moving class of work entirely, the yearly tonnage would be about one-half of the average. The expenses would be about the same and, therefore, the costs for conducting the business would be twice as much per ton as on average jobs. Unfortunately, most foundrymen fail to add the ½ cent increase for overhead, although they may be laboring under the delusion that they are adding it under the extra cost of molding.

Let us consider another job in which the reserve condition applies. This can be molded at the rate of 1,000 pounds per day per man and the tonnage produced, therefore, will be twice the average of 500 pounds. The overhead expense per ton then will decline about one-half; let us assume that it is 50 per cent. From the average cost should be deducted the amount saved in molding and also one-half of the overhead cost, or $5 per ton. The amount chargeable for overhead will then be ¼ cent per pound instead of the standard ½ cent per pound. On this class of work the tonnage per year would be double and with the overhead expenses practically constant, it is apparent that the overhead per ton would be only one-half of the previous average overhead. In competing for business the foundryman who does not take into consideration the variables cited will not get the order and only too frequently complains that his competitor did not know his costs and obtained the work at ruinous prices. It follows then that the foundryman, without an adequate cost system, readily secures all the difficult work on which no profit can be realized, as his price is liable to be lower than his competitor on this class of work, whereas he is not favored with the better class of work or the rapid-moving jobs owing to his failure to consider the variable overhead. This condition will prevail regardless of the fact that this foundryman may be able to produce castings as economically as his competitor.

To define more clearly the results obtained by figuring on a variable overhead and a constant overhead, we will cite the following examples: It will be assumed that the overhead cost per molder, or floor, is $2 per day. Two jobs are accepted; on the one the output is 200 pounds per day and on the other, 1,000 pounds per day. It will be assumed that on both jobs the molder receives $3.50 per day. The following roughly illustrates the method of estimating or calculating the costs recommended:

	Production per day, per man, 200 lbs.	Production per day, per man, 1,000 lbs.
Direct cost (molder one day at $3.50)	$3.50	$3.50
Other constant costs at 85 cents per 100 lbs.	1.70	8.50
Assumed average overhead per molder or floor	2.00	2.00
Total cost	$7.20	$14.00
Actual cost per pound	0.036	0.014

If these two tasks had been figured in the old manner of distributing costs, except direct cost for molding, we would obtain the following results:

	Castings, weight. pounds. 200	pounds. 1,000
Direct cost	$3.50	$ 3.50
Average constant cost, assumed average overhead cost per pound at 1.183	2.37	11.83
Total cost	$5.87	$15.33
Assumed cost per pound	0.0293	0.0153

It will be noted, therefore, that by the recommended method of figuring the cost of 200 pounds of castings it would be 3.6 cents per pound, as compared with only 2.93 cents per pound by the old method. In other words, the slow-moving job, by the old method of figuring, would take a lower price than the slow-moving job by this method of estimating. On the contrary, the fast-moving job, involving 1,000 pounds of castings, would be charged for at a higher rate by the old method than by this plan, namely, 1.53 cents per pound, as compared with 1.4 cents per pound.

The effect of the proposed system is to load a higher cost on slow-moving jobs. It is believed that foundrymen generally have appreciated the necessity for this, since it is evident that a shop which is compelled to operate on slow jobs does not turn out as many, nor does it get the returns that it would on jobs permitting a higher tonnage. It is not claimed for the foregoing system that it will prove to be 100 per cent efficient, but in most instances it will be above 75 per cent accurate, and in some lines this may exceed 90 per cent.

This report would not be complete without incorporating a recommendation for the adoption of a general form for ascertaining the annual or monthly operating cost, including the totals of the three following fundamentals: metals consumed, material consumed, and labor and salaries.

These items can be subdivided and distributed over the different foundry departments, this distribution, shown on the accompanying form, being as follows:

1.—Melting department.
2.—Molding and core department.
3.—Cleaning department.
a.—The total of these gives the producing total of metals, material and labor.
4.—Pattern department.
5.—Flask department.
6.—Power, light and heat.
7.—Repairs and maintenance.
8.—Yard.
b.—The total of the foregoing shows the entire manufacturing cost.
9.—Rent account, including insurance, taxes, obsolescence or depreciation, and interest on plant account.
10.—Administrative or executive expense, including balance of interest, salaries, stationery, telephone, postage, etc.
11.—Sales department.
12.—Extraordinary charges.
c.—The total gives the general cost.
13.—Castings returned from customers.
d.—Grand total of the entire cost. The item of total dollars expended should check with the ledger.

This will give the general average cost for the tonnage produced and

can be used as the cost standard if the principal differentials are added or subtracted. It also can be employed in the nature of a check on the results of each foreman from month to month or what is termed "the control or comparative cost." In the foregoing subdivisions is included the item of extraordinary charges. This is separately indicated to eliminate from the preceding departments any unusual charges which would not be constant and would otherwise affect the control cost or prove to be unreasonable charges against a certain department for the month.

To obtain this result the use of a voucher system is recommended. It also is essential to have an accurate payroll distribution for each department, and it is necessary to make a detailed distribution and accounting of all materials used. It is necessary to ascertain the accurate tonnage produced by weighing the castings or estimating such castings as cannot be weighed in bulk in the cleaning room on the first of each month, or any other period decided upon, and to add the increase or subtract the decrease from the month's shipments. The amount produced is used as the divisor of the amount charged to each department and also the total value charged to all departments, according to the amounts shown by the voucher record or ledger. If this production divisor is not correct, it throws out the cost for the month and the succeeding month.

The accompanying chart is compiled con an assumed production of 500 tons per month and it will be noted that it records the amounts charged to each department and the cost per ton of material and labor and the total cost per ton for each department. While the foregoing gives the average of one month only, it is necessary to obtain averages covering periods of one, two or as many years as desired to obtain an average that will cover a period of trade depression and periods of prosperity. In the compilation of these averages practical knowledge and common sense should be employed. Remember that the metal is not the only merchandise sold and shipped. While the metal cost is fairly constant, it fluctuates somewhat as the result of the remelting of scrap, including heads, gates, risers, etc. In explaining the methods by which the average is obtained, the figures on the accompanying chart will be referred to. It is essential to ascertain the average remelt, especially that of heads and gates, so that if an order takes a large head the proper differential should be added to the standard average cost of $65.30.

At this point it might be advisable to direct attention to the wide fluctuation in the percentage of castings shipped and the total melt in various shops and for different classes of work. This variation, while being greatest in steel casting work, also is a factor of importance in iron foundry practice. One large manufacturer operates two iron foundries, one on light and the other on heavy work. The output of the light foundry averages 5 pounds per casting, while the output of the heavy work shop averages 125 pounds. The proportion of shipments to melt of the light shop is 55 per cent, while that of the heavy shop is 70 per cent.

After having obtained the total average cost of $65.30, subtract the amount of direct or productive molders' and coremakers' labor, which is $10, leaving a total of $55.30. After ascertaining the direct or producing molding and core labor per ton for a job which is not exactly the average, namely $10 per ton, add to this the sum of $55.30. In other words, $55.30 is the starting point for all costs and possibly might be termed "zero labor" or the cost of castings exclusive of the molding expense.

Since the cleaning cost was not included in the direct or productive labor on which the overhead was based, it will be taken care of as follows: According to the accompanying chart the average cleaning cost is $8. If the casting is difficult to clean, the cost will exceed this amount and if it is below the average in cleaning expense, it will be less than the average of $8. This difference should be added to or subtracted from the average cost of $55.30. It is not difficult to ascertain for any casting whether it is more or less expensive than the average pattern to remove the heads and gates, or to judge whether it takes more or less grinding, chipping, etc., than the average. Large heads, excessive core work, etc., as a rule, mean high cleaning costs. From experience one can readily determine whether the cost should be increased or decreased as a result of abnormal or subnormal cleaning of any design.

Next, ascertain the average of the defective castings made in the foundry. Then add to or subtract from $55.30 an amount covering these defectives which may be estimated, or is shown by the records as applying to the particular pattern in question.

It may be approximately assumed that items Nos. 4 to 11 on the accompanying chart make up the overhead expenses. The cost per ton will vary more or less with the production, but the total amount charged against these departments will remain fairly constant. Therefore, the average overhead per ton is readily obtained and is shown to be $15.43, or approximately ¾ cent per pound. In order to apply the first theory referred to, the following examples may be cited: If the job is strictly of an average type costing $10 for direct molding and core labor, the total cost will be $65.30. If the job is slow-moving, add to the standard average cost of $55.30 the proper amount of overhead. If the castings cost $20 for direct molding and core labor, which is double the average of $10, they carry $30 overhead, or twice the average of $15, which results in $55.30 plus molding and core labor, plus $15 extra overhead, and equals $90.30.

If he job is rapid-moving, and the castings cost only $5 for direct molding and core labor, they carry an overhead of only $7.50, or one-half of the $15 average. Therefore, to the $55.30 standard average cost we add $5 for molding and core labor, which equals $60.30 and from which we subtract $7.50 for reduced overhead, and then arrive at a total cost of $52.80.

In this connection, it is interesting to direct attention to the wide fluctuations in the cost of fast and slow-moving work as compared with the average job. The average job in this case is represented by $65.30; the fast-moving job at $52.80 and the slow-moving job at $90.30.

The proper variations can be figured for every $1 per ton above or below the average molding and core labor cost of $10. For all practical purposes a variation of $2.50 per ton, or ⅛-cent per pound, will be sufficient. The result of the cost obtained on any particular pattern will not vary widely from that secured by a more elaborate system which is difficult to understand and frequently so burdensome that it will not receive the hearty co-operation and support of the heads of the operating department.

From the foregoing examples the following simple instructions will aid in arriving at the proper costs. On the accompanying chart the grand total is given as $65.30.

Add or subtract for heads and gates above or below the average or standard.

Add or subtract the difference between the specific and the standard direct molding and core labor cost.

Add or subtract the difference between the specific and the standard or average cleaning cost.

Add or subtract the difference between the specific and the standard, or average defectives.

Add or subtract the proper differential of overhead costs.

Add contingencies, extra flasks, pattern changes, etc.

By following these instructions the total cost of a casting of any pattern can be obtained.

Most foundries do not hesitate to pay

(*Continued on page* 1302b)

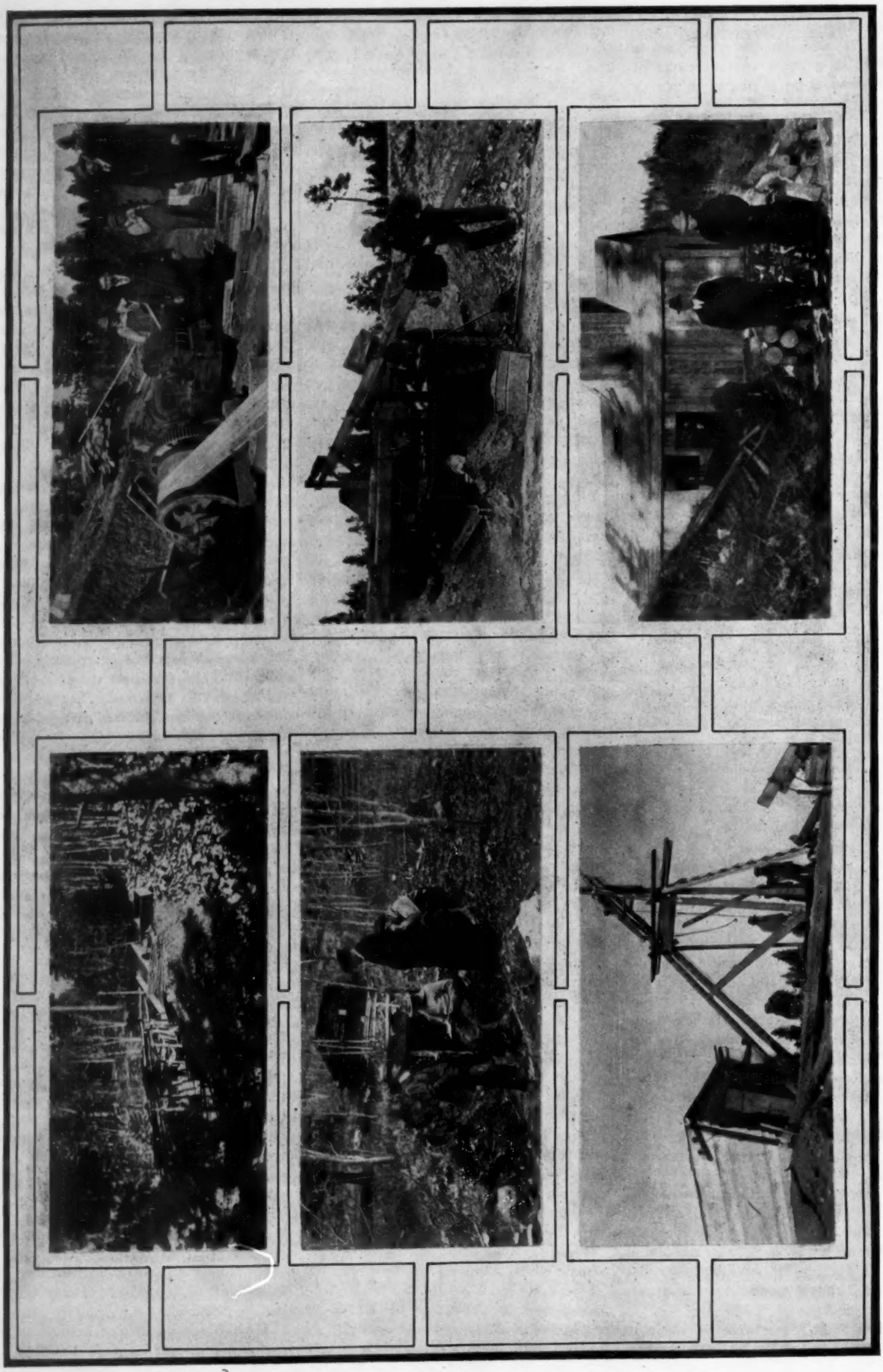


FIG. 4—HOW TUNGSTEN IS MINED IN THE BOULDER, COLO., FIELDS

These views were taken at the mines of the Vasco Mining Co. At the left is shown a view near No. 4 mine, entrance to No. 4 mine, and pumping operations at No. 7 mine. At the right is shown the installation of the air compressor and hoist at No. 7 mine, jig at No. 1 mine, and shaft house at No. 7 mine

Mining Tungsten Ores in Colorado

THE EUROPEAN WAR, in causing the United States to examine its domestic resources, furnished many surprises. Among these was the realization that with some of the world's largest tungsten ore deposits, foreign nations supplied many of our products. The new industry, launched as a result, relieved a serious situation; but will this business outlast the war? Mr. McKenna here furnishes the answer.

By Roy C. McKenna

TUNGSTEN finds its greatest use as an alloy of high speed steel. Together with chrome, it imparts to the steel the property of holding its temper at higher temperatures than carbon steels. In high-speed steels, from 16 to 20 per cent of tungsten is used. The manufacture of magnet steel also has consumed large amounts of tungsten, but probably 90 per cent of all tungsten ore mined, is used in making high speed steel. There are four kinds of tungsten ore, ferberite, wolframite, hubnerite and scheelite. All of these are mined in the United States. Ferberite ore is a combination of iron and tungsten; hubnerite, of manganese and tungsten; scheelite, lime and tungsten, and wolframite of iron, manganese and tungsten.

Tungsten ore mined in the United States comes from deposits in Arizona, California, Colorado, Idaho, Nevada, New Mexico, South Dakota, Washington and Alaska. The production of the United States has been recorded only since 1900, but the output in preceeding years was small. The oldest and best known tungsten mines in the world are located in Spain and Portugal. The best grade of ore and the best producing mines are found in Boulder county, Colorado. In the United States geological survey's report for 1913, Frank L. Hess, in discussing the Boulder field, says, "The district is unique, in that it is the only large ferberite producing district in the world". The Burma fields, located in the Federated Malay States, are the most recent deposits discovered, and in the year 1914, were the largest producers of tungsten ore in the world. Tungsten ore is also mined in many other countries, including Australia, India, Japan, Siam, Argentine, Brazil and Peru. Although tungsten ore deposits are found in so many sections of the world, the production in 1912 was only 9,654 net tons of 60 per cent tungsten trioxide concentrates, or less than 10,000,000 pounds of tungsten metal.

The tungsten deposits of this country have assumed new importance since the European war forcibly brought home the realization that this country was, to a large extent, dependent upon other nations for its supply of alloying materials. The accompanying article by Roy C. McKenna, president of the Vanadium-Alloys Steel Co., Pittsburgh, will be found, therefore, of unusual interest. Mr. McKenna, as head of the Vanadium-Alloys company is ably qualified to discuss the mining of tungsten ore and its conversion into various products.

The main source of supply in the United States for scheelite ore is in California. This ore is also imported from South America and Japan. Wolframite ore is imported into the United States at the present time from Spain, Portugal and South America. In normal times, large quantities of wolframite ore are imported from the Federated Malay States and Australia. The exportation of tungsten ore from any of the British colonies to any country except Great Britain and her allies is now prohibited. Hubnerite ore is mined in Arizona and New Mexico, but the quantity on the market is very limited. Both wolframite ore and hubnerite ore sometimes contain copper and tin, two elements which must be eliminated in ferro-tungsten, before it can be used in the manufacture of high speed steel. Ferberite ore is the best grade of tungsten ore, and has always commanded a premium in price over the other grades. The only large ferberite producing district in the world is in the Boulder, Colo., field.

The methods of mining all kinds of tungsten ore and the formation of all tungsten fields are similar. This article, however, discusses only the Boulder county deposits, with which the writer is more familiar.

Tungsten minerals, like tin ore, generally occur in veins cutting through granite rocks. Tungsten ore in the Boulder field is mined in veins. The vein in many cases is no thicker than a lead pencil. Again, it may be as thick as a man's arm, and in some instances, as a man's body. The ore in these veins contains from 3 to 10 per cent tungsten trioxide. When one vein leads into or crosses another, a "pocket" of tungsten is found. A pocket of tungsten generally contains about 1 cubic foot of ore of about 65 per cent tungsten trioxide. If three or more veins meet at the same point, a room of tungsten may be formed. A room of tungsten would contain about 2 cubic yards of mostly 10 per cent tungsten ore, with several pockets of high grade ore averaging from 60 to 65 per cent tungsten trioxide.

Tungsten mining in the United States and in all other parts of the world, is conducted along very prim-

FIG. 2—SCHEELITE, COMBINATION OF LIME AND TUNGSTEN. DARK SPOTS SHOW TUNGSTEN

FIG. 3—WOLFRAMITE, COMBINATION OF IRON, MANGANESE AND TUNGSTEN

FIG. 4—FERBERITE, COMBINATION OF IRON AND TUNGSTEN

itive lines. For years tungsten mining has been unprofitable, as the cost of obtaining the ore has been in excess of its market value. Investments in tungsten mines have not appealed to conservative investors, and most large tungsten properties in Boulder county, Colo., are owned and controlled by ultimate users of tungsten metal. The ownership of tungsten mines is only justified in securing a permanency of supply to the manufacturer.

The large producing properties in Colorado are operated through lessees. It is a general practice in Colorado for the mining company to allow the lessee 75 per cent of the market value of the tungsten ore mined. The mining companies of Boulder county usually furnish their lessees with electric hoists free of charge, the lessees having to pay only for the electricity used. In many of the shafts, the mine owners have furnished compressed air for drilling, at or near cost to the lessee.

A deep fascination is found in tungsten mining, and there is always the gambling chance of striking a rich deposit. Owing to the small size of the tungsten vein, it is necessary to remove a great amount of dirt and rock. In the Boulder county fields, very few of the tungsten mines are profitable to work to a greater depth than 100 feet, despite the fact, that the deeper the mine shaft is sunk, the richer the deposit of tungsten ore. The deepest mine in Boulder county is 800 feet, and although at this depth the ore is richer, the increased cost of mining hardly justifies operation.

In the past year, the enormous demand created for high speed steel by the large orders for war munitions, coupled with the prohibition of exports of ore from the British colonies, has increased the price of tungsten ore to five times normal. To meet the increased demand, the mine owners and miners are being forced to operate many of the least desirable veins. In California, at the present time, a vein of 1 per cent scheelite ore, 2 inches in diameter, and running through solid granite, more than 800 feet under ground, is being mined.

Owing to the nature of tungsten deposits, the discovery of any large fields is unlikely. However, upon the discovery of new fields, tungsten ore is produced rapidly, since the deposit can be operated as a placer mine. The new tungsten field seldom produces nearly as much, in following years, as in the year of discovery.

The Burma tungsten fields alone rival in production the deposits of Boulder county. The Burma fields have produced and sold in past years, more tungsten than Boulder county, not because they were richer, but due to the lack of tariff protection. The price of tungsten ore in the United States did not permit mining operations to be carried on profitably, and the Burma fields could operate only because of the extreme cheapness of coolie labor.

The primitive methods used in mining tungsten in the United States are due not to lack of progress, but to the unwillingness of capital to invest the large sums of money necessary, in a business of such uncertainty. Experience has taught mine owners that the temptation which lured the gold miner to lose his fortune, is present in tungsten mining to an even greater extent. The mine owners have adopted the policy of allowing the men, whose livelihood depends upon production, to select the vein to be worked. By this means, conservative policies are insured.

One of the least known but most important of the new industries, established as a result of the war, is the manufacture of ferro-tungsten. Formerly, the American consumers of this product bought their supply from foreign manufacturers. As ferro-tungsten is almost entirely used in making high speed steel, little explanation or imagination is required to show the helpless position of this country, in the event of hostilities with, or between, other nations. For this reason, it is hoped that the government will recognize the great value of this new industry, and that congress will afford a measure of protection to the capital already invested, so that the menace of foreign control may be permanently removed.

A considerable quantity of tungsten is also used in the manufacture of incandescent lamps, which are fast displacing the carbon lamps. Tungsten wire, it is said, may be drawn to smaller sizes than any other metal now known. It is used also for contact points in spark coils, etc. Dr. Fink, of the General Electric Co., states that tungsten is well suited for standard weights, since wrought tungsten can be made hard enough to scratch glass, and still be ductile. Tungsten weights remain wonderfully constant. Medical science is beginning to recognize the value of tungsten, and it has been suggested that fine tungsten wires be used in surgical operations, instead of the coarser gold and silver wires. The automobile manufacturers, recognizing within the past few years that tungsten combined with chrome imparts to steel the quality of retaining its hardness at high temperatures, have created an unusual demand for high speed steel for automobile valve stems.

Evidently, the commercial possibilities of tungsten have been hardly touched and new uses for this metal are being found daily.

A barrel hoop, containing a projecting nail, was lying on the floor of a shop shed. A boilermaker's helper stepped thereon and his foot was punctured. Barrel hoops have caused serious injuries when stepped upon and caused to fly up or trip persons and they are of course all the more dangerous where the nail hazard is added.

A meter repairer was soldering a meter and the solder came in contact with some water, causing it to "pop" into his eye. Goggles are suggested for use while doing this kind of work.

FIG. 5—FERRO-TUNGSTEN

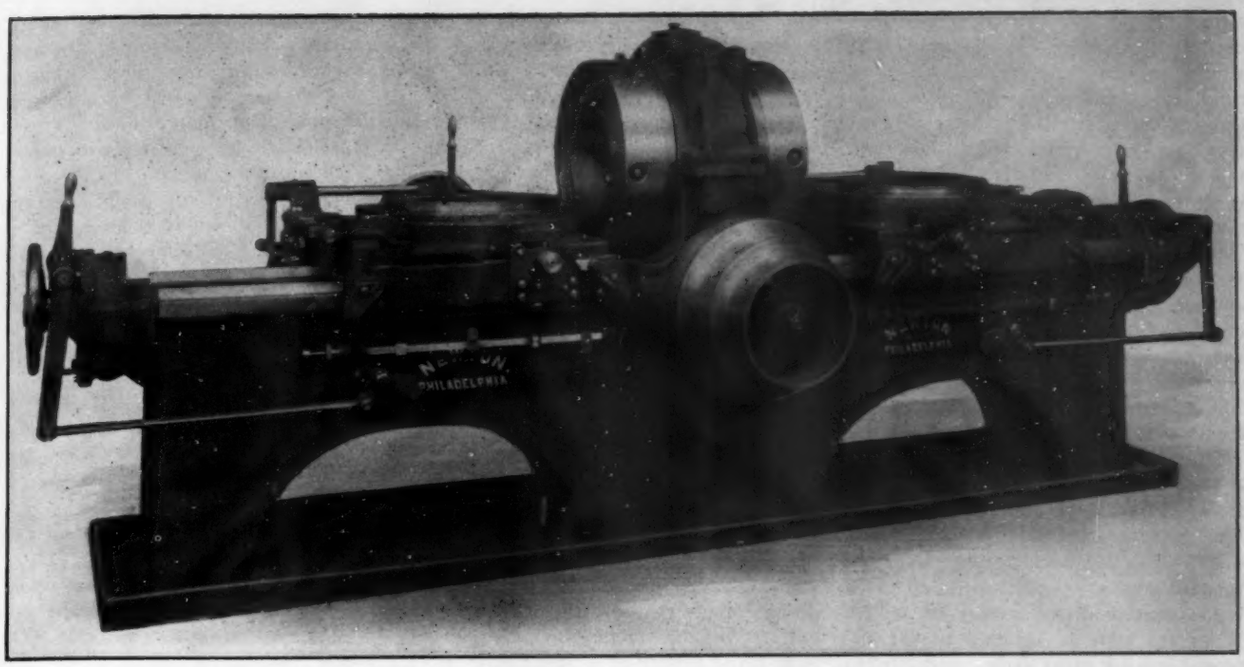


Fig. 1—Boring, Turning and Facing Machine for Automobile Rear Axles

Brings Out Three Novel Machine Tools

WHEN the manufacturing industries are prosperous, great activity is always shown by machine tool builders in designing new tools or in incorporating new devices on old models. A natural corrollary, therefore, of conditions during the past few months has been the bringing out of large numbers of new machines. The Newton Machine Tool Works, Inc., Philadelphia, has taken a leading part among the tool builders who have been active in augmenting their line of products. The accompanying article and photographs describe and illustrate three of the Newton company's latest designs of tools, comprising a vertical milling machine, a profile milling machine and a boring, turning and facing machine.

This latter machine, which is employed in machining automobile rear axles, is shown in Fig. 1. This tool was built for a large western automobile manufacturing company. It has individual cross and longitudinal saddle feeds, with positive turret feed stops, giving four positions to the longitudinal and two positions to the cross feed. The turrets have circular adjustment with six stations and are arranged to carry removable tool holders.

The spingle head carries a three-jaw universal chuck on each end, giving internal capacity to hold members up to 12 inches in diameter. The drive to the spindle is through a large bronze spiral gear and hardened steel pinions from a four-step cone. All saddle motions are secured from the main pulley shaft through a gear speed box having a 5 to 1 range, giving a change without removal of gears. All motions are independently clutched through four hand levers, release being effected by dogs on the saddles which engage stops. The turrets are 18 inches in diameter on the working surface. They are accurately grooved to facilitate the attachment and interchange of tool holders. The maximum distance between turret centers is 6 feet 6 inches. This machine is also adapted for simultaneously trimming closed ends and cutting the excess length from open ends of shells up to 12 inches. Under suitable conditions it can be used for contour boring the interior.

Since being redesigned, the company's extra heavy vertical milling machine is said to have unusually flexible control, permitting the use of end mills as small as ¼-inch diameter when the machine is used for sinking dies. On the other ex-

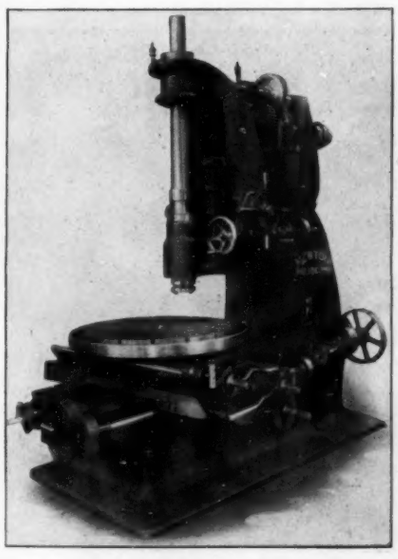


FIG. 2—VERTICAL MILLING MACHINE

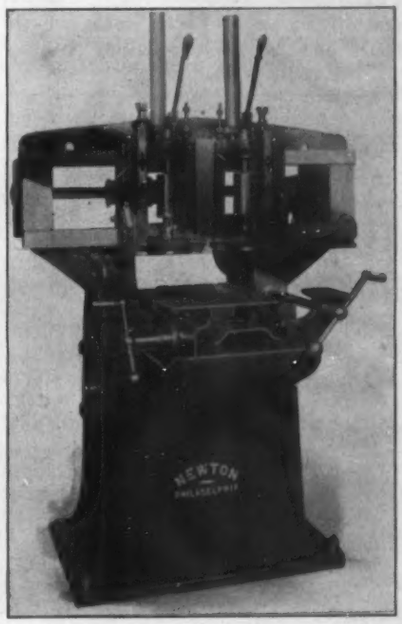


FIG. 3—PROFILE MILLING MACHINE

treme, heavy locomotive milling is successfully performed. As shown in Fig. 2, alternating current, motor drive can be secured easily, as speed changes are obtained through the speed box gearing without removing any gears. An important feature of the tool is the counterweighted spindle saddle with power vertical feeds and fast power movement. The new design also includes reversing fast power traverse for the circular, in-and-out, and cross table motions which also have reversing power feeds and hand adjustments. All of these motions are controlled from a central position. The diameter of the circular table over the slots is 42 inches, with a cross feed of 30 inches and an in-and-out feed of 20 inches. The spindle speeds range from 8½ to 232 revolutions per minute. The table is of corner clamp construction. When the circular table is in the forward central position, work up to 38 inches outside diameter may be milled. When the table is adjusted to the extremes of the cross slide, work up to 48 inches outside diameter may be handled with 8-inch diameter cutters. A number of these machines, it is said, are now being employed for milling solid shrapnel forging ends.

Fig. 3 illustrates one of a number of profile milling machines recently built by the Newton company, which embodies first of all the required accuracy, the usual features of this type of machine, and some important changes in design. The spindles, which are mounted on separate slides having hand vertical adjustment, revolve in double taper bronze boxes at both top and bottom. These boxes are adjustable to permit of precise running fits. Each spindle slide is poised on a stout spring mounted inside of covers, which act as an automatic saddle return. A lever controls the vertical movement, of which the extremes are determined by fixed and adjustable stops. The compounded spur gears which engage the adjusting rack at the bottom of the saddle are controlled by a hand lever. For lengthwise operations the table is moved through compound gears, controlled by another lever. Spur gears only are used throughout. Each of these is made in two cylindrical parts to allow for expansion. The spindles are driven by continuous belts, which are guided by a sliding idler pulley. As the work is turned out in large volume at the automobile plant where these machines have been installed only two spindle speeds are provided, 840 and 1,200 revolutions per minute. The machines which are rigidly constructed throughout have the following dimensions and specifications:

	Inches.
Diameter of spindles through pulley.....	1⅞
Distance end of spindle to table, max...	5½
Min. distance end of spindle to table....	3
Fixed distance between spdl centers.....	12
Distance of each spindle center to center of table, maximum.....	7–19
Width of table over surface.....	12
Length of table over surface.....	15
Maximum table movement.....	21½
Width between uprights.....	19

The work table has two tee slots. It is surrounded by a lubricant pan arranged with drains leading to a removal reservoir, which is mounted on the rear of the base of the machine.

Install Hydraulic Press in Record Time

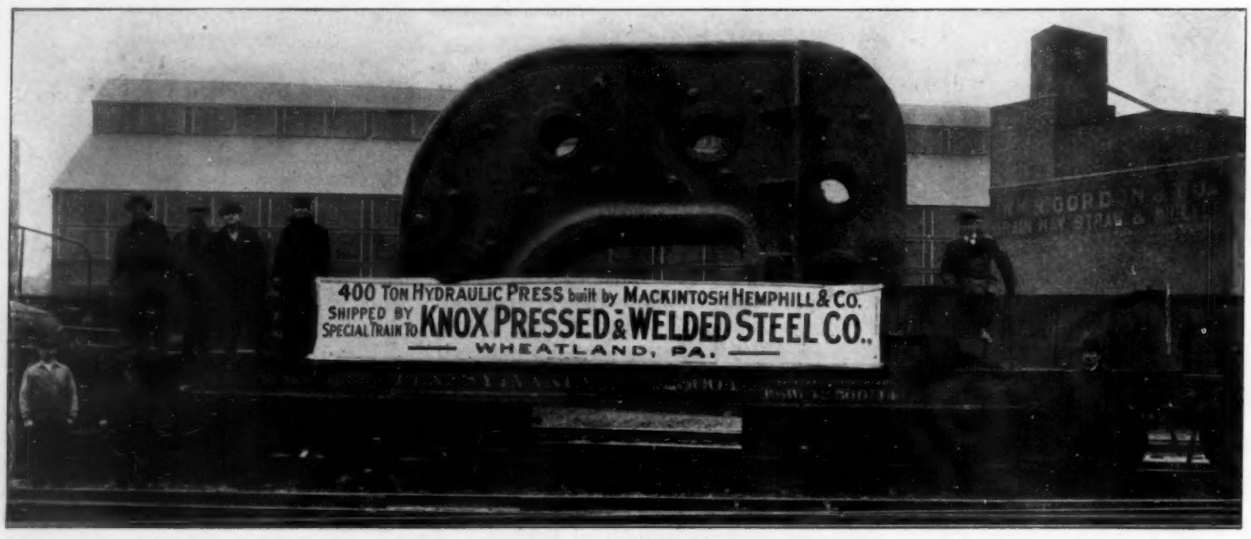
A NEW record for handling and installing heavy machinery was set recently in equipping the new plant of the Knox Pressed & Welded Steel Co., Wheatland, Pa. At 6 o'clock on the evening of Nov. 30, a special train consisting of a locomotive and two cars left the works of Mackintosh, Hemphill & Co., Pittsburgh, with a 400-ton hydraulic flanging press for the Wheatland plant.

The train was run over the Pennsylvania railroad. The special reached the new Knox works in six hours and 30 minutes, despite a delay while two brass journals in one of the cars was being repaired. The setting up of the press was completed by the afternoon of Dec. 2. It was necessary to summon a 90-ton crane from the Conway yards of the Pennsylvania railroad in order to lift the press from the cars. The press, however, was installed in less than 48 hours after leaving Pittsburgh.

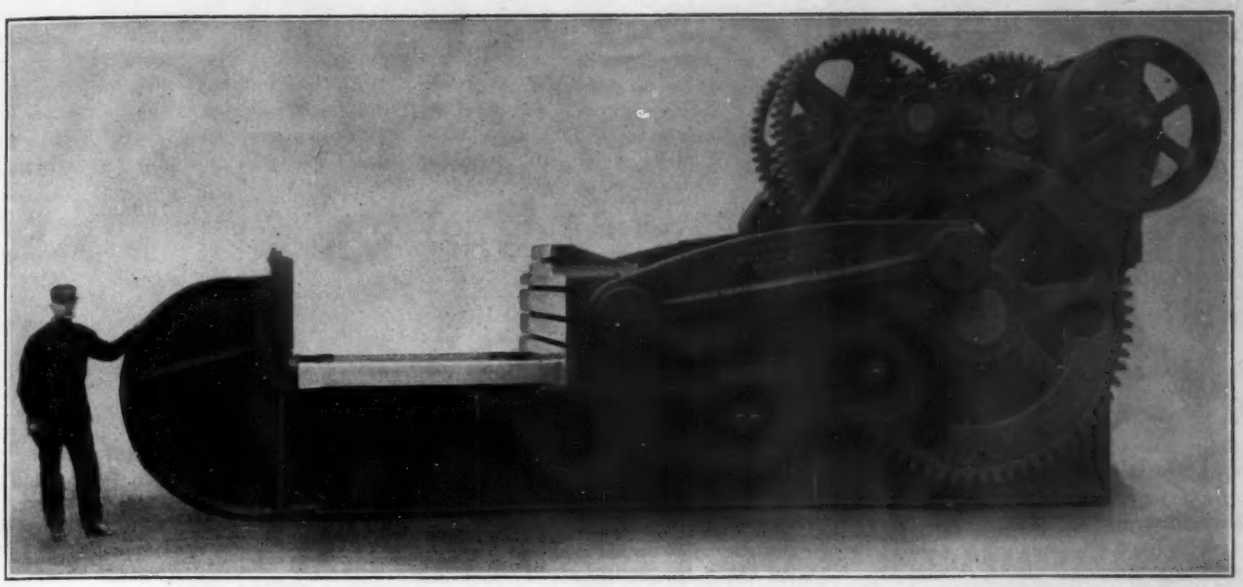
This press was designed and built especially for the Knox company by Mackintosh, Hemphill & Co. It is of 400 tons capacity and weighs 160,000 pounds. The new Knox plant is equipped with unusually heavy machinery for handling heavy plate work. The main building is 130 x 500 feet. All tools and cranes are motor-driven.

The Heinle Co., Crafton, Pittsburgh, Pa., metal rolling engineer, has issued an explanatory chart showing in detail the proper shape of all roll grooves for hexagon rolling.

This interesting chart shows the method for laying out all leading grooves for any size hexagon. The specifications give the exact dimensions of the billet during its progressive stages through the rolls. These data are of considerable value.


400 TON HYDRAULIC PRESS built by MACKINTOSH HEMPHILL & CO.
SHIPPED BY SPECIAL TRAIN TO KNOX PRESSED & WELDED STEEL CO.
WHEATLAND, PA.

LARGE HYDRAULIC PRESS ON SPECIAL TRAIN



LARGE BULLDOZER USED IN FORGING SHELLS

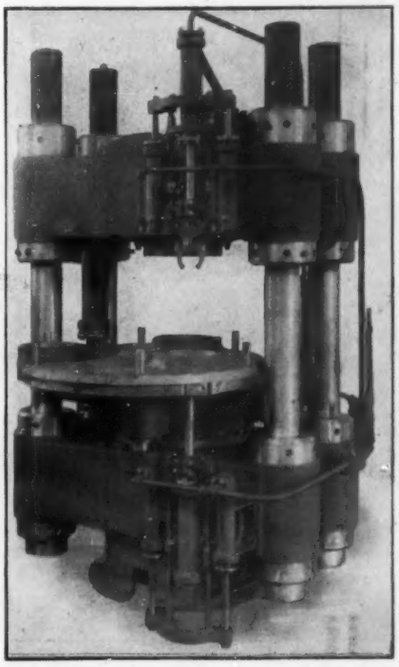
A Large Bull Dozer of Recent Design

THE bulldozer, shown in the accompanying illustration, was designed and built recently by Williams, White & Co., Moline, Ill. This immense machine is 26 feet long and 12 feet wide. It exerts a pressure of 500 tons distributed load, which is said to be 50 per cent greater than any bulldozer previously built. All gears and pinions are steel, with cut teeth. The main bed and side arms are cast steel. A large steel shaft is fitted through the sliding casting, the ends of which serve as trunnions. The machine is driven by a 75-horsepower motor, direct connected through cut gearing. The motor rests on a bracket bolted to the housings. This machine has forward and reverse gearing, both movements being controlled by friction clutches. Tee slots are provided in the crosshead and ways. The end lugs are provided with taper gibs instead of the usual adjusting screws, for adjusting the dies. This machine is being used for forging shrapnel and high explosive shells.

Shell Heading Press

The hydraulic press shown in the accompanying illustration has been added recently to the line of projectile presses now being built by the Hydraulic Press Mfg. Co., Mt. Gilead, O. The machine is designed for heading brass shells after they have been indented.

The heading operation is accomplished by inserting a fullering block between the head of the press and the top of the cartridge case, the latter being held in place by a die. As the pressure is applied, the fullering block causes the brass to flow outward in all directions, forming the head of the shell. The press has a revolving turret with dies to receive three shells. By this arrangement practically continuous operation is secured, one shell being headed while the second is being ejected and the third is awaiting the heading operation. Through an indexing device, the rotation of this turret is so controlled that the shell is held in place directly beneath the fullering block. This indexing device is operated through a lever shown at the extreme right. When the lever is pulled, the index latch is disengaged from the turret, clearing and releasing the latter for revolving. The turret revolves on a spindle mounted on ball bearings which are set in the front side of the press between the strain rods. The turret is revolved by handles placed around its outer edge at equal distances.



HYDRAULIC PRESS FOR HEADING SHELLS

When the heading operation is completed, the shell is pulled from the die by an hydraulic ejecting device consisting of two rams, one attached to the head and the other to the base of the press. Spring gripper jaws are attached to the upper ram for gripping the head of the shell. Each ram is provided with two auxiliary pull-back rams. In ejecting a shell, the ram attached to the base of the press forces the shell out of the die to a point where the gripper jaws on the upper ram can readily take hold of the newly formed head. Pressure is then applied on the auxiliary rams for returning the ejector rams. The finished shell is then removed from the gripper jaws of the upper ram and the device is ready for the next shell. The use of two ejector rams, each working toward a common center, is said to make the ejecting operation more rapid and as the turret is cleared in less time, it can revolve more quickly for heading the

next shell. The maximum pressure of the two ejector rams is 5 tons each.

The press is of steel construction, the base and cylinder being cast in one piece. The diameter of the ram is 28 inches with a stroke of 12 inches. The daylight space of the press can be varied from 30 to 45 inches. The maximum pressure capacity of the press is 1,000 tons. The number of shells which can be headed depends upon the capacity of the pump used in operating the press. With the pump furnishing 19¼ gallons per minute at a pressure of 3,250 pounds per square inch, the press will head shells in two minutes.

Employment of Cast Vanadium Steel Dies

THE use of alloy steel castings for die making has attracted considerable attention in recent years, due to the advances made by foundries specializing in their manufacture. Cast steel dies are now being successfully used by drop forging manufacturers, plow manufacturers for making plow shares, and by sheet metal workers for forming dies in the production of sheet metal specialties, kitchenware, etc. C. R. Messinger, vice president, Sivyer Steel Casting Co., Milwaukee, furnishes the following information relative to the use of vanadium carbon steel in die making.

Die Making is a Specialty

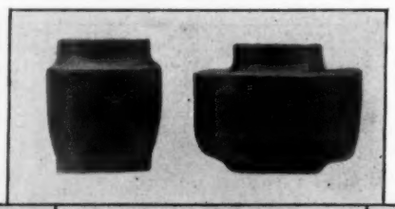
The Sivyer company specializes in the making of such dies. The service obtained from cast dies depends largely upon the vanadium, carbon, phosphorus, silicon and manganese contents. Vanadium is used to increase the toughness and hardness, and it is said that dies embodying this metal have high wearing qualities, together with great resistance to cracking or breaking under the battering to which dies are subjected. An illustration is furnished showing that a run of 40,000 automobile brake support forgings, each 20 inches long, was made from cast vanadium-carbon dies without any great amount of wear. The Sivyer company also has received a report from a plow manufacturer showing that such dies in his shop lasted six times longer than cast iron dies and were cheaper than hammered blocks.

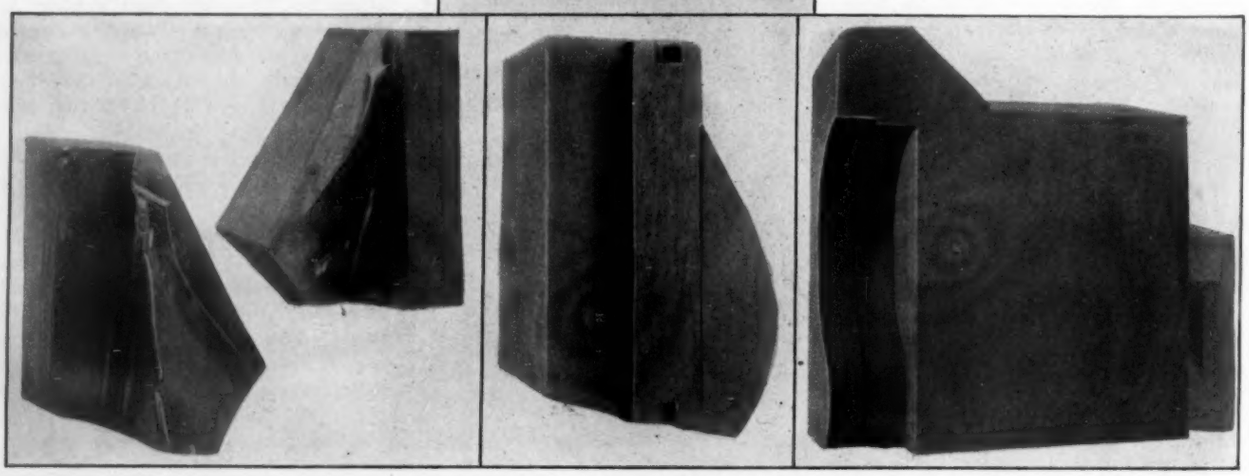
Cast steel dies can be made in any shape, effecting a saving in material and machining. For general drop forge work, the usual practice is to cast the dies with the tenons and with the impressions for breakdowns approximately to shape, allowing a small amount for finish. The impression for the die is then sunk in the solid block.

Finish Allowance

For plain forgings, the impressions are sometimes cast in the dies, with an allowance for finishing. In dies for making plow shares, all impressions are cast in the dies, allowing about ¼-inch metal for finishing. Forming dies for sheet metal also are cast approximately to shape with a finishing allowance.

After annealing and machining cast vanadium dies, they are heated to 1,500 or 1,550 degrees Fahr. and quenched in oil for a fairly hard surface and in salt water for a hard surface. Ordinarily no additional heat treatment is required.





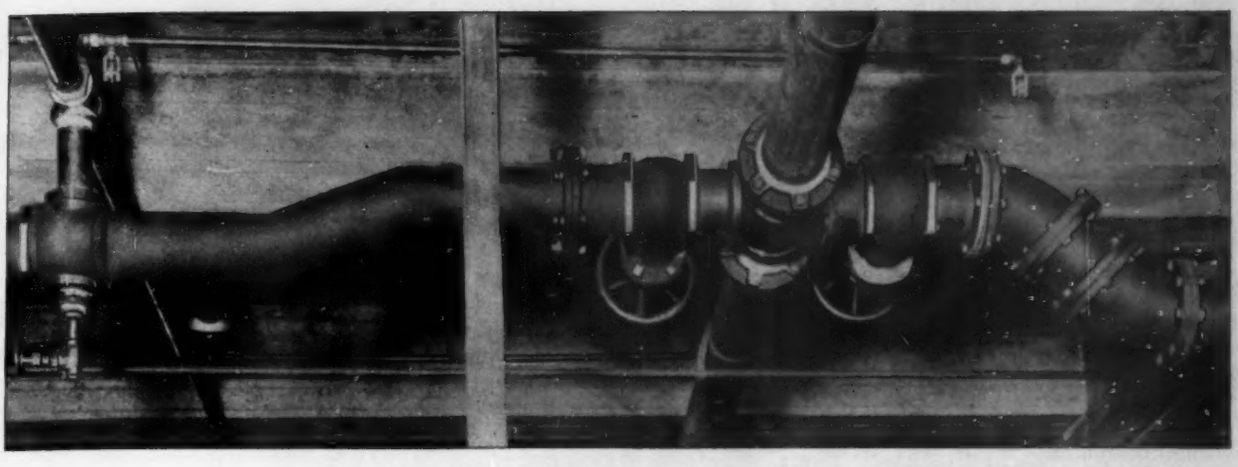
FROM LEFT TO RIGHT:—HOW STEEL DIES FOR PLOW SHARES ARE CAST; REAR VIEW OF DIE FOR MAKING PLOW SHARES, SHOWING TENON CAST ON DIE; PATTERN FOR DIE FOR DROP FORGE WORK, IMPRESSIONS FOR BREAKDOWN ARE CAST TO SHAPE WHILE FORMING DIE IS SUNK IN FLAT SURFACE. ABOVE:—PATTERNS FOR FORMING DIES USED IN MAKING KITCHENWARE

Book Reviews

The Corrosion of Iron, a summary of causes and preventive measures, by L. C. Wilson, 178 pages, cloth, published by the Engineering Magazine Co., New York, and sold by *The Iron Trade Review*, Cleveland, at $2.

This is one of the volumes making up the Works Management Library. It collects and presents in simple form some of the more interesting and important facts connected with the corrosion of iron, and the methods of preventing such action.

Ever since the phenomenon of corrosion and the means of overcoming the destructive action of rust have been studied scientifically, literature on the subject has multiplied in accordance with the importance of the subject. Much of this is scattered through scientific and engineering journals and is not readily available. Mr. Wilson has endeavored to collate and condense the conclusions reached by numerous investigators. The student or engineer in reading this work, gains an insight into the difficulties involved in successfully protecting iron and steel from corrosion. The successes achieved and the difficulties still unsolved, are stated clearly. The subjects treated are still matters of controversy among investigators.



PIPE CONNECTION WELDED BY OXY-ACETYLENE PROCESS

Welding Large Pipe Under Difficulties

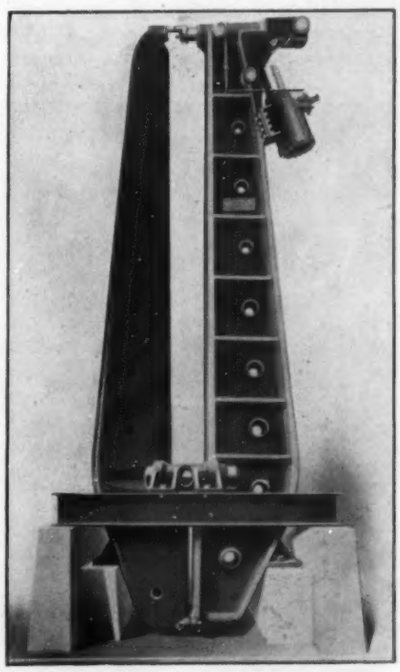
THE broadening use of oxy-acetylene welding in repair work is shown by an incident occurring recently at the Indianapolis plant of the Prest-O-Lite Co., manufacturer of dissolved acetylene. In extending the sprinkler system it became necessary to run branches from a 6-inch water main. This main had been hung so close to the ceiling that offsets in the branches were required to clear the concrete girders and other piping already in place. Ordinary screwed fittings were employed until on one side a drop of 7½ inches was required, making impossible the use of these fittings with 6-inch pipe. This connection was finally made by using 45-degree flanged elbows and nipples, giving the pipe a 12-inch drop.

On the opposite side of the main, a different problem was presented. A downward offset of 5¼ inches was necessary to clear the pipes above and below the new line. It was decided that standard fittings could not be used, and an estimate was obtained on the cost of bending the pipe. This estimate was $18.60. One of the employes then suggested the use of oxy-acetylene welding and a short section, cut at each end at the proper angle, was welded into the line at a cost of $3.40. The accompanying illustration shows the completed job.

Large Pneumatic Riveter

A pneumatic riveter, believed to be the largest ever construted, has been built recently by the Hanna Engineering Works, Chicago. This machine is shown in the accompanying illustration. It has a reach of 21 feet and is designed to exert a pressure of 100 tons on the rivet die at 100 pounds air pressure. Its weight is 40 tons. Through the use of a pressure regulating valve in the air supply line to the riveter the pressure of air at the cylinder can be changed quickly to vary the pressure on the rivet dies in order, it is said, to produce any tonnage the operator desires for the size of rivet he is driving.

The operation of this riveter is similar to previous types built by the Hanna company. Toggles, levers and guide rings are combined to give the large opening of the toggle joint movement with its gradually increasing pressure until the desired point is reached, following which is a simple lever movement through a considerable space until approximately maximum pressure. After the machine has been adjusted for a certain length of rivet and thickness of plate, no further adjustments are required. The piston stroke of the cylinders is 22 inches, the relative travel of the rivet die being 5¾ inches. The toggle action occurs during the first half of the piston travel, which represents approximately 4¾ inches of the die travel. At this point, the mechanism automatically changes into a simple lever action without a critical point, the rivet moving forward 1 inch during the last 11 inches of the piston travel. This riveter is said to be especially adapted for boiler, tank and structural work.



LARGE PNEUMATIC RIVETING MACHINE

Interesting Bulletin

In an interesting 24-page booklet, the American Rolling Mill Co., Middletown, O., describes completely the various steps in the manufacture of its various iron products, beginning with the selection of the raw materials, such as ore, pig iron and scrap. The open-hearth furnaces employed are also fully described, with the method of charging and melting. The theory of the process is graphically, yet simply explained for the benefit of the layman and the illustrations which accompany the text aid in its clear understanding. The pouring of ingots, the soaking pit process, blooming and rolling into sheet bars are described, and the methods of reheating and rolling, annealing, pickling and cleansing and the final galvanizing and inspection are taken up in detail. An interesting feature described and illustrated is the cold saw method of investigating ingot structure.

A New Duplex High Speed Hack Saw

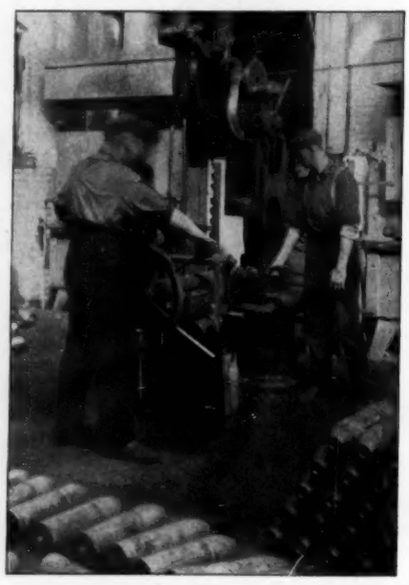
THE duplex high speed power saw shown in the accompanying illustration is a recent development of the Clarence E. Van Auken Co., Chicago. The machine was designed primarily for rapid production, which is secured through the use of two saws giving 270 cutting strokes per minute. Standard hack saw blades are used. One saw cuts on the down and the other on the up stroke, making the sawing continuous. Both saws feed alternately into the stock and release on the return stroke. The body of the cast frame is hollow and is partly filled with a cooling solution. The saw frames are heavy seamless tubing. They are provided with a ball check valve on the lower end which works up and down in the solution, forcing the liquid up through the tubes and down on to the saws. By this arrangement, the saws are constantly flooded while the machine is operating, eliminating the necessity for a pump. The machine is provided with positive clutch drive, automatic stop, adjustable tension feed, stock gage, etc. The vise screw is right and left threaded for moving both jaws, thus keeping the work in a central position. The blades can be reversed, thus increasing their life. The saw is belt-driven. The machine illustrated has a capacity of 4 x 4½ inches, with a stroke of 6½ inches. The saw blades are 12 inches long and the driving pulley is 14 inches in diameter. Operating on low carbon steels, the pulley is driven at 135 revolutions per minute. The height to the bottom of the vise is 24 inches. The floor flange is 10 x 16 inches. The net weight is 145 pounds. The saw is built in a larger size, which has a capacity of 8 x 8 inches, with a 7½-inch stroke and 17-inch saw blades. The speed of the pulley is 135 revolutions per minute. This saw is driven by a 4-inch belt in place of the 3-inch belt used on the smaller machine.

DUPLEX HIGH SPEED SAW

Safety in the Foundry

"Safety in the Foundry" is the title of a 188-page volume by Magnus W. Alexander, of the General Electric Co., Schenectady, N. Y., who is chairman of the committee on safety and sanitation of the National Founders' Association. The book is published under the ausipces of this organization and can be purchased by those who are not affiliated with this society at a net price of $1.50 per copy.

This book has grown out of the investigations carried on during the past two years by the author in his capacity as chairman of the National Founders' committee on safety and sanitation and while considerable of the information was published by the committee in the form of bulletins, the book contains this material in a revised form brought up to date and enriched by illustrations not published heretofore. Many new features have been incorporated and entirely new chapters have been added. A chapter on physical examination of employes has been appended because of the conviction that the physical fitness of an employe for his work, equally with the safe condition of work rooms and work tools, is an essential element in the safety and well-being of the employe. The strongest appeal for recognition that can be made by this work is the fact that it reflects the experience and expert judgment of many practical foundrymen and foundry executives throughout the country. They have contributed many valuable suggestions and their shops have been utilized for practical experiments with safety devices, the effectiveness and desirability of which were to be proved before they could be recommended for adoption. The bulletins as originally issued by the National Founders' Association attracted wide attention and the suggestions and recommendations contained therein have been followed in many shops with the result that working conditions today are more satisfactory from the standpoint of the employe than heretofore. No undertaking in recent years by any association has been directed toward a more humanitarian goal than this and the work throughout reflects the painstaking effort of the author and his co-workers. The volume will prove to be a valuable addition to every foundryman's library as every phase of safety work pertaining to foundry operations is covered in detail.



NOSING SHELL UNDER POWER HAMMER

Shell Nosing Hammer

Power hammers built by Beaudry & Co., Inc., Boston, have been successfully adapted to the nosing of large shells. The accompanying illustration shows one of the company's hammers nosing a 75-millimeter shell. These hammers have been furnished for forming shells up to 155 millimeters, in diameter, and it is claimed that they can handle even larger sizes. These hammers, it is said, are used in the manufacture of rifles, swords, bayonets, trench digging tools and in the repair shop departments of explosive factories.

The Trussed Concrete Steel Co., Youngstown, O., describes its mesh for reinforcing concrete floors, roofs, roads, pavements, sewers, conduits, tanks, walls, culverts and bridges, in a recent 32-page bulletin.

Iron and Money: Fact and Comment

Interesting Facts About Earnings of British Companies—Steelmakers Will Lose on Account of Government's Raid on Profits

Office of *The Iron Trade Review*,
Prince's Chambers, Corporation St.,
Birmingham, Eng., Dec. 20.

THE great steelmaking firms stand to lose something by the government raid upon profits, and this has not been allowed to pass without protest, especially by those great ship building and armament firms which in times of peace often had to complain of lack of consideration in giving out of orders. It is notorious that departments of these firms were idle, a year before the war, for lack of orders. The firm of John Brown, for example, complains that it was never encouraged by the government to increase its capacity, and the fact that it was in advance of government demands, when the crisis really rose, is, it contends, entirely due to the firm's own enterprise. It should be added that these great firms are paying large sums for the maintenance of the dependents of those employes who have joined the army. An extract from the speech of Lord Aberconway, presiding at the meeting of John Brown & Co., may be worth quoting:

"A very foolish agitation had been got up against what were called war profits. A certain group of politicians had attacked armament firms in the house of commons, and daily newspapers were holding them up to public obloquy, stating they were making unreasonable profits, and so their resources ought to be crippled. Could anything be more unfair? It was even alleged that they had encouraged a war program. That was true of Krupps; they lived and worked for the war that had been brought about. British armament firms had tried to checkmate Krupps, and hoped to go on doing so. "We have developed our business resources in order to protect the British empire. Some people may have been blind as to the designs of Germany. We never overlooked those designs, and we persisted in spite of great expense in providing a minimum plant for defensive purposes. That plant even today is not equal to the demands of the country, but had it not been for John Brown and similar firms we would like to know what would have become of the country. Our soldiers would have been practically unarmed and our shores would have been defenseless."

The speaker went on to remark that the profits for 50 years had averaged 8 per cent, and a risky business demanded a fair profit. It might very well be that for a few years they might be without profits at all.

Some Good Earnings

A glance at the records of the principal iron and steel concerns, following a year of war, shows that they have no particular ground for depression. To take a few examples, the Steel Co. of Scotland and Pearson & Knowles both increased their dividends from 5 to 7½ per cent. The Stavely Coal & Iron Co. maintained its dividend of 12½ per cent and made a bonus distribution equal to the addition of a share; Guest, Keen & Nettleford, 15 per cent; dividend and bonus, Sheffield Forge & Rolling Mills, 12½ per cent; Brightside Foundry, 12½ per cent; Bolckow, Vaughan & Co., 6 per cent. This is the same as last year, but represents a reduction from 10 per cent in the previous year. Armstrong, Whitworth & Co., 10 per cent; Sheepbridge Coal & Iron Co., 15 per cent, in addition to a substantial surplus for extensions; Vickers, Ltd., 12½ per cent; Hadfields increased from 20 per cent to 22½ per cent with large appropriation to reserve; William Jessop & Sons, dividend and bonus, 15 per cent; William Beardmore & Co., 5 per cent; John Lysaght, 10 per cent, with a bonus of 3s per share, equal to 15 per cent, additional; Metropolitan Carriage & Wagon Co., income and dividend, 15 per cent; William Cook & Co., 7½ per cent.

Messrs. John Brown made a record profit of over half a million, and were able to divide 12½ per cent with a large carry-forward. It is remarkable that the last-named concern made its profits in spite of the fact that 10,000 out of 55,000 men joined the fighting forces, and a somewhat similar story could be told by other concerns.

Big Bond Given

Certificates of deposits for the $4,287,500 deposited Dec. 18 by the Colt's Patent Firearms Mfg. Co., Hartford, Ct., in 13 banks in that city have been given by Colt's to the Aetna Accident & Liability Co., as collateral for the $4,287,500 bond written by that company to guarantee the fulfillment by Colt's of the $13,000,000 order which it has for light Vickers guns and for which the $4,287,500 was an advance payment. Eventually, a large part of the deposit will find its way into circulation in Hartford, through dividends to stockholders, through material purchased by Colt's and through the wages of employes. It will simply be a part of the general wave of prosperity hidden away and mixed with other parts of the wave.

Holiday Spirit Prevails

Holiday spirit had its effect on the stock market last week, which, on the whole, was one of quiet strength. The estimate of L. F. Loree, president of the Delaware & Hudson, that $1,300,000,000 par of United States securities have been returned from abroad from the time the war started 17 months ago shows the wonderful power of this country in absorption. The return of securities still continues, but causes no alarm.

After only moderate changes during the week, the stock market closed Friday afternoon in a cheerful frame of mind. The New York bank statement indicated a loan increase of $26,000,000 and a cash decrease of $21,000,000. Anglo-French bonds were offered in large quantities and sales amounted to about $2,000,000 par value.

Quotations at the close of business Dec. 24 and changes in the leading stocks identified with the iron and steel industry for the week are shown in the following table:

	Close Dec. 24	Net chge.
American Can	61	+1⅜
American Can. prfd.	111¼	+ ½
Amer. Car & Fdy. Co.	78¼	— ½
Amer. Car & Fdy. Co., prfd.	116½	+ ½
American Locomotive	69¾	+1¼
American Locomotive, prfd.	101½	— ½
American Steel Foundries	62	+ ½
Baldwin Locomotive	118½	+2⅜
Bethlehem Steel	471	—3
Colorado Fuel & Iron	52⅝	+1⅛
Crucible Steel	73½	+ ½
Crucible Steel, prfd.	111	— ¾
General Electric	173⅛	+ ⅜
International Harv of N. J.	111	+ ¼
International Harv. Corp.	80	—3
Lackawanna Steel	81	.....
Nat'l Enamel'g & Stamp. Co.	29	+ ⅛
Pressed Steel Car	64¾	+ ½
Pullman Palace Car	165¾	+ ¾
Republic Iron & Steel	54¾	+ ¾
Republic Iron & Steel, prfd.	110⅛	+ ⅛
U. S. Cast Iron Pipe & Fdy.	24	.....
U. S. C. I. P. & Fdy. prfd.	50	—1⅛
United States Steel	87½	+2
United States Steel, prfd.	116¾	+ ⅛
Westinghouse Mfg.	68¾	+ ⅛

Prospects of Pacific Coast

Some Interesting Facts About Iron and Steel Making—Business is Improving

San Francisco, Dec. 26. — Charles C. Jones called attention to the fact, at the San Francisco meeting of the American Institute of Mining Engineers, that in the whole inter-mountain and Pacific coast region, west of Pueblo, Col., from Canada to Mexico, there is no production of pig iron, while steel making is confined to the manufacture of a small amount of open-hearth steel from scrap. It is not due to lack of iron ores, because numerous large deposits are known, particularly in Utah and Southern California; in the latter place, states Mr. Jones, three deposits alone represent 125,000,000 tons of ore that runs 4 to 10 per cent higher in iron than standard Lake Superior ores. Mr. Jones' paper is published elsewhere in this issue of *The Iron Trade Review*.

Discussing Mr. Jones' paper, it was brought out later that Chinese pig iron is sold on large contracts at $18.50 to $19.00 per ton in San Francisco, but that Mr. Jones considers pig iron can be produced on the coast at $14. Carl H. Booth, of Chicago, made the assertion that steel castings made at present on the coast are of poor quality due to unintelligent labor, besides which labor conditions are bad on the coast. Mr. Jones pointed out that Pittsburgh iron and steel shipped by way of the canal would have to pay a freight rate of $4.50 or $6 from New York to California besides the rail freight from Pittsburgh to New York. An opinion was expressed that steel castings would be preferred to iron on the coast if they could be obtained satisfactorily.

Building Most Active

Construction work is picking up on the coast, in fact things are just at the turn. For two years contractors have, as one expressed it, been starving to death. The erection of steel and concrete buildings is beginning again. A large steel and granite hall is being started at the University of California, in Berkeley; Bethlehem Steel has sold the steel for it. At Butte, Mont., the Chicago, Milwaukee & St. Paul Railroad will soon construct a $250,000 depot. At Portland, the Portland Mausoleum Co. will build a $65,000 mausoleum of marble, granite and reinforced concrete. Several new schoolhouses are planned, notably at Kingsbury, Lathrop, Los Angeles, Oakland, Richmond and San Diego, Cal. The Utah Potash Co. will construct an 8-mile tramway near Marysvale, Utah. Pasadena, Cal., is installing new iron pipe, as is also Fresno. Oakland is to have the only automobile factory on the coast, a branch of the Chevrolet company. The Mare Island navy yard near San Francisco is preparing to build 32,000-ton battleships.

Shipyards Active

Ship-building at the Union Works at San Francisco is active. On Dec. 18 the tank-steamer La Brea was launched; this boat, built on the Isherwood longitudinal system and propelled by geared Curtis turbines, is 453 feet long, 56 feet in breadth, has a draft of 27 feet, a displacement of 15,135 tons, a shaft horsepower of 2,600, a speed of 11 knots, a capacity of 70,000 barrels of oil in addition to 3,000 barrels for fuel; its keel was laid Sept. 18. On Dec. 17, for the first time in its history, the Union Iron Works laid two keels in one day; the Annette Rolph for Hind-Rolph Co., 410 feet long, a duplicate of a former boat, and a 440-foot tanker for the Standard Oil Co.

The California Foundrymen's Association held its annual banquet at the Union League Club on Dec. 11, as planned, and a most enjoyable time was had. The new president of the California Metal Trades Association is Constant Meese of the well-known firm of Meese & Gottfried Co.

The demand for steel in certain lines on the coast is exceeding all capacity to deliver it within a reasonable time. It has become more a question of when can delivery be made rather than what price can be made.

The Panama - Pacific exposition closed its gates on Dec. 4, after 18,800,000 people had entered in the 10 months of its opening; over 400,000 people attended the last day; the original deficit of $1,000,000 was paid off and another $1,000,000 cleared.

Presented a Loving Cup

A beautiful engraved solid silver loving cup was presented to James E. Ferguson, president of the Ferguson Steel & Iron Co., of Buffalo, last Saturday night, Dec. 18, by the assembled employes of Mr. Ferguson. The presentation speech was made by Charles W. Hyne, general manager, and speeches outlining the steps in the success of the Ferguson Steel & Iron Co. were given by a number of the prominent guests present. The event included a theater party and a banquet at the Hotel Lafayette, and was attended by about 50 employes and guests.

Consolidation

Of American Foundry Equipment Co. and Sand Mixing Machine Co.

The American Foundry Equipment Co., Cleveland, manufacturer of sand blast machinery, has been consolidated with the Sand Mixing Machine Co., New York City. The headquarters of the consolidated companies will be located in the Vanderbilt Concourse building, 52 Vanderbilt avenue, New York City, with a branch office in the Columbia building, Cleveland. The two companies, while allied, will continue to operate under their individual names. The Sand Mixing Machine Co. builds the auto sand mixer, which is employed for cutting sand in foundries, 225 of these machines now being in operation in casting plants throughout the United States. The American Foundry Equipment Co., of Cleveland, established by H. L. Wadsworth, builds a complete line of pressure system sand blast equipment and also designs and builds sand blast cleaning outfits for special purposes. The standard machines include an automatic sand blast tumbling barrel, automatic rotary table sand blast room, automatic sand blast cabinet and an automatic monorail sand blast outfit, a double monorail sand blast plant of this kind recently having been installed by the Aluminum Castings Co., Detroit. V. E. Minich, vice president of the Sand Mixing Machine Co., with headquarters in the Vanderbilt Concourse building, New York, will have charge of the sales and finances of the consolidated companies and H. L. Wadsworth, Columbia building, Cleveland, will be in charge of production and design.

The P. H. & F. M. Roots Co., Connersville, Ind., has taken a contract for two gas exhausters and two gas boosters for the Indiana Coke & Gas Co., Terre Haute, Ind., to be installed in its new coke oven plant, contracts for which were awarded to the Gas Machinery Co., Cleveland.

Quincy Stove Mfg. Co., Quincy, Ill., has increased capital stock from $125,000 to $145,000.

News of Employers and Employes

Generous Distribution of Profits and Gifts by Many Companies—
Christmas Spoiled for Some by Strikes

ONE million dollars is a conservative estimate of Christmas gifts to employes of New England manufacturing establishments by their employers and the amount would have been much larger if it had not been for the machinists' strikes that have prevailed for several months. The metal trades industry in that section never has had a more successful year, due in a large measure to the European war, and the owners have felt so jubilant about it that they were inclined to share à part of it with the men who helped to bring it about. But the machinists' strike put a damper on the plan in several of the large shops and not one where there was a strike received any of the good fortune. The men who remained loyal to their employers were not forgotten in many instances, however, and thousands of them had the merriest Christmas of their lives. In Massachusetts, six concerns gave away $240,200, of which Worcester's share was $115,200, the largest known in history. The biggest individual gift was that of the Graton & Knight Mfg. Co., Worcester, the largest leather belt manufacturer in the world, which, for the first time, distributed the magnificent sum of $85,000 among its 1,700 employes, this being the greatest ever made by any concern doing business in that city. And it came as the result of loyalty and efficiency on the part of the employes. Nothing like it has ever been heard of in Worcester. In speaking of the bonus, W. Virgil Spaulding, secretary of the company, says: "Due to the cutting off of common European sources of supply for certain leather products more than to the demand for leather primarily for war purposes, there has been an opportunity to enter new commercial fields and to develop new lines of manufacturing formerly closed to this company. The unusual character of these new demands, the suddenness with which they came and the entirely unprecedented business conditions which have existed, made necessary a considerable amount of extra work on the part of employes of all ranks. The situation was cheerfully and energetically met by all to the great satisfaction of the management. In acknowledgment of this loyalty and increased effort, a sum of approximately $85,000 has been distributed as a Christmas present from the company to its employes. The share of each individual is determined by the amount of wages received by him during the year 1915."

The Christmas distribution to the 451 employes of the Wyman & Gordon Co., Worcester, was $11,600. The company has a branch in Cleveland, which was taken of similarly. The workmen, no matter how humble, who had worked the largest number of years received the largest amount. The men in the employ of the company six months or less, received $5; less than one year and more than six months, $10; and for those who had periods of service beyond six months, $5 was given for every year of service. The oldest employe, having worked continuously 27 years, received $145. The regular weekly payroll of the company last week was the largest in its history.

Worcester Pressed Steel Co. distributed $10,600 to its 300 employes, averaging about $350 each. It was in the nature of a bonus or dividend rather than a Christmas present, the officials said, and was given in appreciation of their services the past year, by the directors of the company, of which John W. Higgins is president. One of the reasons for the generosity on the part of the company is that the past year it has been rushed with war and domestic orders, working day and night, and the officials say the employes, to a man, have pitched in and worked hard to aid the company in fulfilling its contracts. Each employe who has been with the company more than six months was given $10, while those who have been with it less than six months received $5 each. The highest amount any employe received was $2,000 and the lowest $25, this not including the $5 and $10 men. The company announces that it is going to do the same thing again in a few months.

The Royal Worcester Corset Co. gave each of its factory employes, numbering between 1,500 and 1,600, a $5 bill, the company distributing about $8,000 as a Christmas gift.

The 1,800 employes of the Norton Co. and the 600 employes of the Norton Grinding Co., Worcester, were each presented with a Christmas turkey from Michigan. It applied to the employes anywhere in the United States and Canada.

In paying the 6,000 operatives of the United States Cartridge Co., Lowell. Mass., Dec. 24, $118,000 was used. This Christmas payment in addition to weekly wages of each employe also included the advance to all employes of the company engaged in the recent strike. That increase was recommended by the state board of conciliation and arbitration.

Mayor-elect Marcus A. Coolidge, Fitchburg, Mass., president of the Fitchburg Machine works, gave each of his 450 employes a $10 gold piece as a Christmas present.

The Simonds Mfg. Co., Fitchburg, Mass., remembered its employes at Christmas by distributing about $2,500 in crisp bills. Those employed by the company more than six months were given $5 each and those under that time $2. There are about 400 employed in the plant.

A gift to the 1,000 employes of the L. S. Starrett Co., Athol, Mass., tool makers, of a sum equal to 2 per cent of the amount of wages they earned during the past year was announced Dec. 24. The company stated that it was able to make the gift because of the increased business caused by the European war. Its statement in part is: "The war has stimulated activity in a great many machine shops and other plants where fine mechanical tools are used. And this activity has increased the demand for our products. Had we been in a position to make shells, or other munitions, or to make machines for making those things, we probably could have received large orders for them, but we are not equipped to make that kind of products, and it seemed to us wise to confine ourselves to the manufacture of our regular line of goods rather than to go to the expense of fitting up to make something entirely different, especially as no one can tell how long the European war is going to last." The company has introduced piecework into the various departments this year as a result of which the men working that way have averaged 25 per cent more pay than they would have received at day wages.

The Potter & Johnston Machine Co., Pawtucket, R. I., announces a 5 per cent increase in the pay of all of its more than 1,000 employes as a Christmas gift and as a step in the profit-sharing policy of the company. A previous increase of 5 per cent in the wages of the workers was granted in August, following a brief strike of

part of the men in the works. James C. Potter, president of the company, says the new increase has no connection whatsoever with the strike of last summer or with the demands made by the men at that time. The new wage schedule will take effect Jan. 1. The machinists on strike at the plant have called it off. It was broken by the men deserting the ranks and going back to work, a custom that has prevailed in other New England cities recently.

The failure of Frank M. Bemis, a special agent of the Massachusetts state board of conciliation and arbitration to bring the officials of the New England Westinghouse Co. and the striking toolmakers at the company's river plant in Chicopee Falls, Mass., together for a conference, has resulted in a public investigation being called in Springfield, Mass., of the strike situation this week. The refusal of the company to confer with its striking employes has caused a temporary deadlock in the situation, which promises to become more aggravated by the calling of a general strike in the factories in Chicopee Falls and East Springfield. Vice President L. A. Osborne, of the company, has issued an open letter to the employes of the company in which he said in vigorous terms that the company will continue open shop conditions as a matter of principle. Eighty of the toolmakers who are out on strike at the river plant have gone to Bridgeport, Ct., where they secured positions in the factory of the Remington Arms & Ammunition Co. In commeting on the situation, Business Agent E. J. Zoerb says: "We believe that the scarcity of good mechanics will have more to do with determining the outcome of the strike than any other factor".

Organizer Joseph H. Gilmour has been arrested again in Worcester, Mass., for addressing employes of the Cambridge street plant of the Reed-Prentice Co., where a machinists' strike is pending, but has not appeared in court on account of being sick.

A representative of the Lombard Machine Co., Ashland, Mass., has secured 60 of the striking machinists in Worcester, Mass., to go to that town, where they will be employed on a night shift.

Played Santa Claus

St. Louis, Dec. 28.—Clarence H. Howard, president of the Commonwealth Steel Co. of St. Louis, and a director of the Boatmen's Bank, played Santa Claus to 2,000 employes of the steel company at Granite City, Ill., Saturday, and distributed approximately $2,500 as Christmas presents. Special gifts were made to the older employes. All who had been with the company more than eight years received $5 gold pieces, and all members of the official staff were given $10 gold pieces. Department heads received from $15 to $20.

Seeks Employes

Indianapolis, Dec. 27.—The Montpelier Mfg. Co. of Montpelier, Ind., announced last week that it is in the market for more employes, large orders having been received recently which have given the company more work than it can do. The orders are for Sunflower mills, Page engine cups and oil well cups. Charles Morse, manager, announced that the company has just received one of the largest orders it has ever received from the National Supply Co. of Toledo, O. The advance in the price of oil has created a heavy demand for pumps and oil cups of all varieties, according to the company.

Its Largest Year

Kenosha, Wis., Dec. 27.—The American Brass Co. has distributed the sum of $35,000 among its 1,800 office and shop employes at Kenosha, Wis., as a Christmas gift to celebrate the largest year's business the concern has ever experienced. Every employe participated in the distribution, which was made regardless of the length of service, age or position of the employe. Checks for 10 per cent of the 1915 wage were issued to office employes and foremen, while a check equal to one week's wages was presented to each employe of the mill and factory. In no case was the check less than $12, while some men were paid as high as $250. The entire distribution was a surprise.

Demands Protective Tariff

A plea for the imposition of a tariff for the benefit of the chemical and dyestuff industries of the United States was made Dec. 23 by the Chember of Commerce of Pittsburgh. The chamber, in a formal resolution, urges upon congress the necessity of protecting, by an adequate tariff, the infant industries that have been developed since the outbreak of the war in Europe.

James L. Foster, of the German Chemical Co., speaking in behalf of the resolution, explained that the by-product coke industry is the basis of the manufacture of colors and of many chemicals. Briefly, he outlined the remarkable growth of the by-product coke oven industry in the United States the last few years. Up to the beginning of the war, Germany furnished 85 per cent of the world's production of dyestuffs and during the year preceding the war exported $45,000,000 worth of colors and chemicals to this country, Mr. Foster declared. He referred to the development of the tin plate industry in this country and attributed the wonderful growth to the adoption of protective tariff policies.

New Machinery Company

Frank L. O'Brien and Clarence J. O'Brien, formerly with Frank Toomey, Inc., Philadelphia, have formed a company known as the O'Brien Machinery Co., and have opened an office and sales room at 107 North Third street, Philadelphia. The company will handle a general line of machinery, including machine tools, steam and electrical equipment, woodworking machinery and supplies of all kinds, both new and used. The company has a warehouse and organization equipped to store and overhaul all machinery before shipment. It desires catalogs, price lists and jobbers' discounts on machine tools, steam and electrical equipment, woodworking machinery and supplies from manufacturers wanting representation in Philadelphia territory.

Will Build Big Dam

Samuel C. Reat, United States consul at Calgary, Alberta, reports that the Edmonton Power Co., Ltd., is planning to build a solid concrete dam, 1,500 feet long and 100 feet high, on the Saskatchewan river above Rocky Rapids, making an artificial lake about 60 square miles in area. Electricity will then be generated in a power plant below the dam and brought to Edmonton in a steel power transmission line. The developments will cost about $6,000,000, not including the electric railway which will be built from Edmonton to the proposed water site. The railway will develop and make tributary to Edmonton a rich mixed farming and timber pulp wood district.

Moving Pictures.—The moving pictures of the National Tube Co., illustrating the manufacture of National pipe from ore to finished product, will be shown before the students of the department of metallurgy, Lehigh university, South Bethlehem, Pa., Friday, Jan. 7, at 11 a. m. Engineers, architects and others interested are invited.

Business News of Nation's Capital

General Crozier Discusses Scientific Management—Results of Inquiry of Plants Making Munitions in the United States

WASHINGTON, Dec. 28. —The practice of scientific management, as it has been in use at some of the government arsenals, was interrupted, to a slight extent, by legislation in the army appropriation act approved March 4, 1915, says Brigadier General William Crozier in his annual report made public Monday. This legislation prescribes that no funds appropriated in the act shall be expended in the payment of any officer or employe engaged in making a time study of an operation, or for the payment of any premium, bonus or cash regard to any employe over and above his regular wages.

"Time studies were in one arsenal only—the Watertown arsenal—and premium payments were made at two —the Watertown arsenal and the Frankfort arsenal lends itself readily "The legislation does not forbid piece-work payment; such payment has since been held by the comptroller to be permitted. The work at the Frankford arsenal lends itself readily to payment upon the piece-work system, and the change from one method of payment to the other was made soon after the law became effective. This arsenal was, therefore, practically unaffected by the law. The work at the Watertown arsenal does not lend itself readily to the piece-work system of payment, but is done principally under appropriations carried, not in the army appropriation act, but in the fortifications act, to which the prohibitive legislation in the army act does not apply. The system of premium payment has therefore been continued at the Watertown arsenal, and the employes have not been directly affected by the new legislation, with the exception of a few unfortunates who are engaged in the hauling of supplies for the quartermaster department, whose pay, as a consequence, has been reduced by the loss of premiums."

Gen. Crozier points out that in his immediately previous annual report he urged that congressional action in regard to the system of scientific management in operation at the arsenals should not be taken in advance of the receipt of the report of the United States commission on industrial relations. The commission itself did not make an investigation at the Watertown arsenal, but it employed a committee, not of its own membership, to do so, of which Prof. Robert F. Hoxie was chairman and the other two members were Robert G. Valentine, representing the employers' interests, and John P. Frey, representing those of labor. This committee made a detailed and thorough investigation and submitted a report to the commission.

Speaking of the report of Basil M. Manly, of the commission, purporting to be a summary of the report of Prof. Hoxie, Gen. Crozier explains that the summary does not contain a special reference to the Watertown arsenal, but says that its statements are the result of an examination of the actual practice of scientific management in 35 shops and systematizing concerns which were visited by the committee. The summary contains several pages of diversities and defects which the committee found in the practice of scientific management at the different establishments.

"Many of these," says Gen. Crozier, "indicate a lack of perfection attained by the practice in many of the shops in which it has been installed; in other words, failure to be scientific, or to reach the scientific standard which the exponents of this youthful method declare to be its proper goal. These shortcomings would seem to indicate what might very well be expected; that is, that unless there is in the meantime disadvantage for employers and employes more than compensating the advantages encountered, efforts should be made to reduce to scientific practice the imperfect applications of the new and only partially comprehended gospel. Among the defects are mentioned failure to substantiate certain claims which have never been made with reference to the Watertown arsenal, at least. Among these are the claim of having established a scientific and equitable method of determining wage rates and the claim to protect workers from overexertion and exhaustion. The solution of the problem of the proper division of the returns of a successful industrial enterprise between the capital involved and the labor employed, in the form of profits for the one and wages for the other, has never been attempted in connection with the establishment of scientific management at the Watertown arsenal; but the claim is made that the result for labor of the pull and haul between these two agencies of production, as exemplified by the wage scale of the vicinity, is taken as a basis upon which to erect an additional advantage to the workman, scientifically determined to be sufficient to induce him to cheerfully make the necessary effort to attain it, which has also been ascertained to be reasonable. As to protection against overexertion in the effort to earn still higher reward, it has not been attempted. It might be argued that premiums should cease, in the interest of the workman, when the production established by time study should be attained, and that additional production should not be accompanied by additional reward. Such a rule would probably be deterrent against overexertion; but since there has never been any claim of overwork at the Watertown arsenal, necessity for the establishment of such a rule has not been made manifest."

A table is submitted by Gen. Crozier, showing that machinists form the most numerous class of employes who have worked upon premium jobs at Watertown arsenal. Of these, 164 worked during June, 1915, upon the whole, 55.15 per cent of their time upon premium jobs, and during this time they earned, over and above their regular wages, which are based upon those of the vicinity, a sum which, on the average, amounted to 24.13 per cent of their wages.

Referring to the matter of manufacture of material, as between the government and private interests, Gen. Crozier said he has considered that the extent to which the government should manufacture its own material should be sufficient to permit the manufacture to be carried on by economical methods; but beyond this point he favors the practice of employing the private industries of the country in order that these might be prepared to serve the government's needs in case of emergency, calling for greatly increased production, which would then be facilitated by the existence of a number of establishments possessing the initial in-

stallation and the technical knowledge required for rapid expansion, as well as by the reserve expansibility of the government establishment employed normally at somethiing less than their full capacity.

"A contract policy has been followed," Gen. Crozier states, "and practically all the appropriations of this department have been accompanied, in recent years, by legislation requiring that the material covered by these appropriations should be manufactured by the government itself, in its own establishments, in some cases without condition, and in other cases under the condition that it cannot be manufactured more cheaply by private manufacturers; exception being made with reference to a very limited expenditure for experimental purposes.

"Under the stimulus of the European war, a number of manufacturers in the United States have established plants, or enlarged existing ones, with a capacity of turning out, in some cases, very large quantities of material of the class for which the demand is greatest in war. Other manufacturers have prepared for the production in smaller quantities of such material, or of components entering it. This department has undertaken to inform itself in some degree as to the location and capacity of these plants for the manufacture of war material, and has received in response to inquiries gratifying statements as to the extent of output which might be expected and the willingness of the proprietors to operate their plants in the service of the government. The accident of circumstance has thus temporarily removed a considerable source of anxiety, but there still remain some matters which should receive careful attention. The permanency of the relief affected is a matter of concern, and of anxiety as to the possibility of devising means for keeping in existence the plants which have been created under circumstances of slight government patronage. Another preoccupation must be the method of rendering quickly adaptable for the manufacture of arms and ammunition of the United States service models, plants which have been equipped for the manufacture of foreign models. The time required for an unprepared adaptation of this kind is sometimes surprising, and in case of emergency would be serious."

Gen. Crozier urges that the nitric acid be manufactured in this country, instead of continuing the present policy of relying upon Chile. The nitrogen in the nitric acid is obtained from the sodium nitrate which comes from that country. It is asserted that facts point to the necessity for inquiry into the possibility of the establishment within the limits of this country of a source of supply of this war essential, and fortunately, it is stated, the possibility exists. There are in successful operation in Europe, in several countries, plants for the fixation of atmospheric nitrogen and rendering it available for use in the manufacture of nitric acid. Gen. Crozier expresses the belief that a steam plant could be established which would contribute effectively to the supply of nitric acid, but is more favorable to the development of water power by private interests of the country, under control of the government.

Increases Granted

Washington, Dec. 29.—Railroad rate increases of direct interest to the iron and steel and metal industries granted by the interstate commerce commission in its western advance rate supplemental decision handed down last Thursday apply to agricultural implements and bauxite ore. The increases became operative yesterday.

The increases on agricultural implements are, in general, 2 cents per 100 pounds and will apply to the territory covered between Chicago and Peoria, Ill., St. Louis, St. Paul, Mississippi river points and points taking the same rates, and points in Iowa, Missouri, Minnesota, North Dakota, South Dakota, Missouri river points and points in Kansas and Nebraska; and also between Chicago, Peoria, St. Louis, Mississippi river points, and points taking the same rates, and St. Paul and Duluth, Minn., La Crosse, Wis., Winona, Mich., and points in Wisconsin, northern Michigan and Minnesota. The only proposed advances which were denied were those affecting points in Louisiana. The term "agricultural implements" is used to include not only farm implements other than hand implements, but various other articles and their parts, which enter into the mixture allowed in carload shipments of agricultural implements. Among the articles included are wagons, sleighs, carriages, and other parts, gasoline engines, windmills, feed mills and binder twine. Agricultural implements, as here used, are made largely of iron and steel, many of them being 70 per cent of metal.

The advanced rate on bauxite ore, used in the manufacture of aluminum, applies from Arkansas points in the vicinity of Little Rock and Hot Springs, the principal movement being from Bauxite, Ark. The increase is uniformly 20 cents per gross ton.

Favors Revision

Washington, Dec. 29.—Hampered by the laws of 1872 which continue to control the industry, the Mining and Metallurgical Society of America at its meeting here on Dec. 16 adopted resolutions urging that the mining code of the United States should be revised. It is proposed that the laws should be revised "not piece-meal, but thoroughly so as to co-ordinate and harmonize its various provisions."

Opens Pan American Scientific Congress

Washington, Dec. 30. — Approximately 1,500 members and delegates are present at the second Pan-American Scientific Congress, which opened in Washington Dec. 27. The first Pan-American reception ever held in the White House will take place Jan. 7. The delegates include 150 representatives of Latin-American governments, scientific institutions and societies, about 700 representatives of American organizations, and about 300 delegates from the leading educational institutions of this country. Headquarters for the congress are at the New Willard hotel.

The convention was called to order in Memorial Continental hall by John Barrett, director general of the Pan-American Union, who is acting as secretary-general of the congress. Mr. Barrett introduced William Phillips, third assistant secretary of state, as chairman of the executive committee which organized the congress. Mr. Phillips called on Ambassador Suarez, of Chile, who took up the gavel as presiding officer of the 13-day meeting.

Scientific discussions began Tuesday morning with the semi-formal openings of the nine main sections of the congress. Section 5 is devoted to engineering, the opening address being delivered by Brig. Gen. William H. Bixby, U. S. A., retired, head of the section. Section No. 7, devoted to mining and metallurgy, economic geology and applied chemistry, is in charge of Hennen Jennings, former president of the London Institute of Mining and Metallurgy.

Today the sections split up into 45 sub-sections, each with its special topics. Resolutions will be acted upon at the closing exercises in Memorial Continental hall on Jan. 8.

Dr. John H. Leete, Carnegie Institute of Technology, Pittsburgh, in a paper on "Co-operation Between Engineering Societies and Engineering Schools", declared that the two important fields for a system of co-operation included the revision, and, to

some extent, the standardization, of courses of study, and the provision of opportunity for closer contact between the school and the profession. Dr. Leete mentioned the existence of a joint committee of the various national engineering societies appointed in 1907 to study the former problem. He suggested that the subject might be simplified by the division of the field, a separate committee being delegated from each society to answer such questions as, What should the graduate know? What should he be trained to do? What particular qualities should be cultivated? He also told of the methods adopted by the Engineers' Society of Western Pennsylvania and the Carnegie Institute of Technology to secure direct contact between the school and the profession.

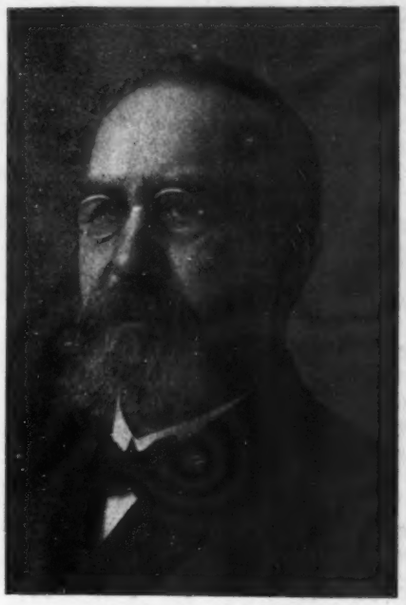
"Only after technical schools have entered into the closest co-operation with one another will the highest efficiency in engineering education be reached," declared Dean Gardner C. Anthony, of Tufts college, Boston, in a paper on "Co-ordination and Co-operation Within and Between Technical Schools". Dean Anthony also stated that co-operation between schools of different grades deserved much more attention. Technical schools, he said, should be more closely allied with the preparatory school and their curriculums should enjoy a closer contact. The co-ordination of departments within the school was held to be of even greater importance than the co-operation between schools. "The period has passed," said Prof. Anthony, "when an instructor may teach apart from his colleagues."

The engineering section will treat of water and land transportation and the various problems of interest to the engineering fraternity. This section will concern itself especially with the constructive discussion of various engineering subjects that commanded the attention of the delegates at the Santiago congress of 1908. Among these is a common Pan-American body of engineering nomenclature and laws regulating the use of water.

Acquires Norton Grinding Co.

Norton Co., Worcester, Mass., has increased its capital stock from $816,000 to $3,000,000 partly for the purpose of acquiring by purchase the stock of the Norton Grinding Co., Worcester, a $408,000 Massachusetts corporation, whose stockholders are identical in name and interest with those of the parent company. The only difference is that the Norton Co. does a grinding wheel business and the Norton Grinding Co., a grinding machine business. No change is contemplated in the organization of the Norton Grinding Co., which will continue to be operated separately.

The Norton Co. owns the real estate used by both companies. Part of the increase has been made from the surplus of the company and the remainder of the new stock will be taken by the present stockholders. The surplus, according to the last annual statement of the treasurer, Charles L. Allen, amounted to $1,437,753, but it has been materially increased this year by the company's doing the largest business in its history.



GEORGE H. GRAHAM

Book Ship Orders

Lake ship builders are now booking orders for 1917 delivery, all the berths at lake yards for 1916 delivery having been filled. It is quite likely that a considerable program for 1917 will have been booked by the end of January, 1916. The Limestone Transportation Co. has just given an order for a conveyor boat for 1917 delivery, to be operated in the limestone trade from Rogers City, Mich. She will be practically a duplicate of the W. F. White, which was delivered this season.

W. H. Becker, of Cleveland, has purchased the steamers A. G. Brower and W. W. Brown from the Great Lakes Steamship Co., making four boats that he has added to his fleet the past two weeks. Other shippers still are negotiating for boats and negotiations likely will be closed within a day or two. The line-up of vessels on the lakes at the beginning of next season will present many changes and names hitherto familiar will be lacking in the list. Grain carriers are in fine demand for opening trips and very fancy rates are being offered. Every bit of available tonnage undoubtedly will be needed.

The Hawgood fleet, consisting of six vessels—the Bransford, J. M. Jenks, H. B. Hawgood, Edwin F. Holmes, Umbria and Wisconsin—has been purchased by J. C. Wallace as agent. The vessels will be operated in the ore trade next year.

Directors of the Interlake Steamship Co. have declared a quarterly dividend of 2 per cent, payable Jan. 1 to stockholders of record Dec. 24. This is an increase of one-half of 1 per cent in the quarterly rate paid during the dull season succeeding the opening of the war. It restores the stock to 8 per cent dividend basis originally paid.

Death of George H. Graham

George H. Graham, of whose death brief mention was made in *The Iron Trade Review* of last week, had been confined to his bed since the day before Thanksgiving, when he fell from the porch of his home and sustained concussion of the brain. The end came Dec. 5. Mr. Graham was born in Oriskany, N. Y., May 21, 1844. In his early business life, he was active as a contractor on railroad and canal work. The Oriskany Malleable Iron Co. was formed in 1879, and Mr. Graham was made superintendent, which position he held up to the time of his death. He had also been secretary and treasurer for many years. He was very active in civic affairs.

H. A. Colwell, 72 years old, president of the National Kittanning Bank and president of the Kittanning Iron & Steel Co., Kittanning, Pa., died at his home in that city Dec. 23. Mr. Colwell had been identified with the iron and steel industry for many years.

Stephen Betts Whiting, for 13 years general manager of the Calumet & Hecla Mining Co., and the supervisor of construction of the "Whiting shaft", at that time the deepest mine shaft in the world, died at his home in Cambridge, Mass., Dec. 23, aged 81 years.

Albert L. Gill, Trenton, N. J., president of the Trenton Agricultural works, died Dec. 16, after a lingering illness. He was engaged in manufacturing threshing machines for many years.

The Brooklyn plant of the American Bridge Co. has been abandoned and now is in process of dismantling.

Russian Buying Buoys Tool Market

Munition Makers Dropping Out of Buying While Domestic Purchasers Come to Front—Pittsburgh Dealers Hampered by English Ruling

HEAVY buying by the Russian commission, having headquarters in the Flatiron building, New York, and by other Russian representatives continues to furnish a large part of the current activity in the machine tool market. The Russian business involves a great many lathes, but is not restricted to this class of machinery, embracing, in fact, a general line. This business is being placed, as a rule, with concerns offering the best deliveries. War buying, however, is becoming a less dominant factor in the market. Not only are England, Italy and other countries buying in much smaller volume than a few months ago, but the orders which are coming from domestic munition-makers are comparatively small. Despite this development, the volume of business in the machine tool market continues heavy. Large builders say that due to the great improvement in the domestic demand for industrial purposes and business for the month of December was fully up to the average of the past four or five months. Several interests claim that on purely domestic buying their volume of sales is larger for December than for November. While this buying does not reflect many especially large transactions, it represents a general improvement in the demand from practically all industries. Steel companies, ship builders, railroads, oil companies, automobile concerns, miscellaneous machine shops, electrical equipment manufacturers, railroad equipment companies, and others, are coming into the market on a more liberal scale than in years. The ship builders, especially, are in need of equipment and practically all of these concerns on the Atlantic seaboard constantly are in the market.

Among eastern concerns who are expanding their capacity are: Chauncey Thomas & Co., Boston; Rome Metallic Bedstead Co., New York; American Piston Ring Co., Newark, N. J.; Athenia Steel Co., Athenia, N. J.; General Smelter Co., Philadelphia; Baltimore Tube Co., Baltimore; Wright Wire Co., Palmer, Mass.; Hart & Cooley Mfg. Co., New Britain, Ct.; Scovill Mfg. Co., Waterbury, Ct.; Jos. Dixon Crucible Co., Jersey City, N. J.; Eastern Tool & Mfg. Co., Bloomfield, N. J.; Riverside Boiler Works, Cambridge, Mass.; Buffalo General Electric Co., Buffalo; Rochester Top Lift Co., Rochester, N. Y.; General Electric Co., Schenectady, N. Y.; Brockway Motor Truck Co., Cortland, N. Y., and the Buffalo Pattern Works, Buffalo.

Chicago Market Normal

Business among machine tool dealers and builders in the Chicago district is in such marked contrast with the closing weeks of 1914 that it is startling to mark the change. Automobile manufacturers apparently are seeking more equipment now than any other one line. Western dealers are somewhat out of the automobile territory, but the fact that inquiries are coming to Chicago for machinery for this use indicates it is difficult to obtain in Detroit and other centers. Multiple drills are especially in demand. English and Canadian buyers continue to seek machinery and some sales have been made recently of considerable size. A manufacturer of farm tractors in Minnesota recently closed for a considerable number of tools for a new plant and will wait several months for delivery. Other activities in the northwest are also demanding consideration. Some shipments for export are being held up in warehouses by the embargo on export business by way of Atlantic coast ports, but this recent ruling is not affecting business materially.

Railroad Tie-Up Affects Pittsburgh Concerns

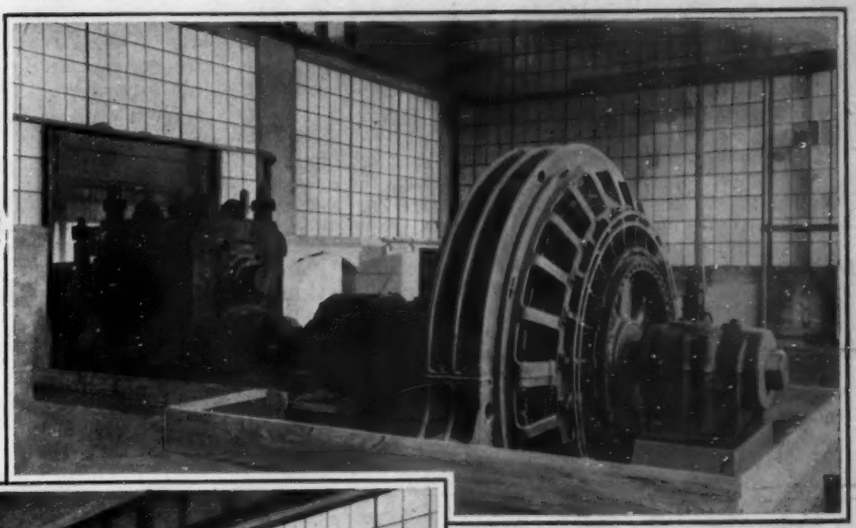
Machine tool dealers at Pittsburgh who have sold equipment for foreign shipment, have been seriously affected by the freight congestion at Atlantic ports. Some exporters express a fear that the situation will become even more acute. Domestic demand for machine tools and heavy rolling mill equipment is improving steadily, although no large contracts have been placed recently. Builders of electric traveling cranes are unable to promise deliveries in less than from three to six months. The National Tube Co., Pittsburgh, plans to build four additional 80-ton open hearth furnaces and a 40-inch electrically-driven blooming mill at Lorain, O. Leading steel manufacturers are understood to be considering appropriations for equipment next year, but no definite programs have been announced.

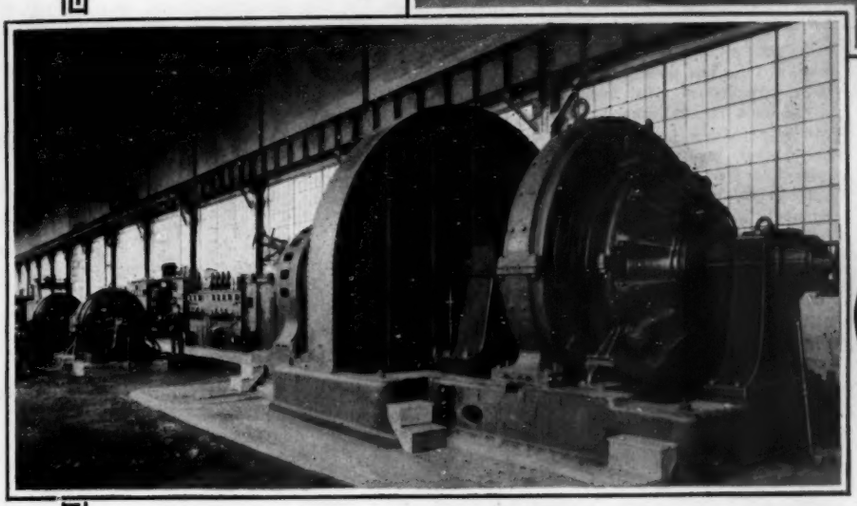
Lull Felt in Cleveland

Machine tool dealers in the Cleveland district find that the demand for second-hand tools is dropping off to some extent. There is no definite cause for this except that munition makers are not entering the market so eagerly, and tools that are available for shell-making are held at a premium. There is a fair demand from Canada, but stipulations regarding delivery are such that little business is being taken. The recent ruling of Great Britain has decreased noticeably the number of speculators and brokers in the machine tool field, and the feverish buying that so lately characterized the market in all districts has subsided. Concerns who have lately adapted their facilities for making lathes and like munition-making tools are bidding strongly for future business. A local dealer made inquiry for several 18-inch lathes from a concern that heretofore had specialized in building printing presses, and found that immediate delivery would be made. It may easily be seen that many of the builders who have entered the market at its present inflated level believe that the demand from domestic users after the cessation of hostilities abroad will be sufficient to warrant them entering this field. These concerns are, therefore, endeavoring to secure future recognition by creating a favorable impression at this time.

Cincinnati Market Slumps

Machine tool builders in Cincinnati are operating for the most part at about 75 per cent of total capacity, and the outlook for future business is less bright than at any time in 1915. Machine tool





Motor Driving Blooming Mill

Motor Generator

A Steady Flow of Power

Electricity, the master motive force that is used throughout our entire up-to-the-minute plant, drives our great 33-inch Blooming Mill.

The powerful 8,500 horsepower reversing Blooming Mill Motor illustrated above *is the largest in the country*. It reverses from high speed to low speed in less than four seconds.

Therefore we are able to take the ingots from the soaking pit at just the right temperature, and at this temperature give them the rapid and thorough manipulation that is essential for *"Agathon" Quality*.

Every feature of our plant is interesting. Are you following the weekly description in The Iron Trade Review?

AGATHON STEELS

"AGATHON" Chrome Nickel
"AGATHON" Chrome Steel
"AGATHON" Chrome Vanadium
"AGATHON" Nickel Steel
"AGATHON" Special Analyses
"AGATHON" Vanadium
"AGATHON" Silico-Manganese
"AGATHON" High Carbon

THE CENTRAL STEEL COMPANY

MASSILLON, OHIO

Detroit Office: 326-27-28 Ford Bldg., F. Walter Guibert, District Representative
Cleveland Office: Hickox Bldg. The Hamill-Hickox Co., District Representative

makers have well-filled order books, extending into the first half of 1916, but orders beyond that time do not seem plentiful. During the first quarter of the year operations were at about 94 per cent capacity, and during the second quarter a slight increase was noticed. There was, however, a falling off to 75 per cent in the last quarter, due to the general strike of union machinists, and a slight lull in orders. The bulk of the demand at present is from domestic sources.

EASTERN STATES

AYER, MASS.—The machine shops built by the Chandler Planer Co. and closed for five years, are to be reopened by the Ayer Machine Co., a corporation, which will make engine and gear head lathes. The plant in normal times employed 200 men.

BOSTON.—Chauncey Thomas & Co., Inc., carriage and automobile manufacturers, have leased a large amount of factory space in the building at 31 Irvington street.

BOSTON. — The Bilodeau Ball Bearing works, has been incorporated; $10,000 capital stock; by Henry L. Bilodeau, K. C. Bilodeau and R. E. Cranker.

BOSTON.—A contract has been awarded for a 4-story, 38 x 150-foot, steel and concrete manufacturing building at 82 K street, South Boston, for the trustees of the Codman building.

BOSTON.—The Boston Electrolytic Oxygen Co. has been incorporated to make oxygen and hydrogen gases; $150,000 capital stock; by Palmer York, D. E. Manson, E. A. Bradley, H. A. Gidney, C. H. Tenney, H. P. Wood and C. F. Smyth. The plant will be located at the General Electric works, Everett, Mass.

BROCKTON, MASS.—A contract has been awarded for a commercial high school to cost $300,000 at Warren avenue and West Elm street.

CAMBRIDGE, MASS. — The Riverside Boiler Works, 34 Harvard street, has started work on a 1-story, 72 x 100-foot boiler shop.

EASTHAMPTON, MASS.—The West Boylston Mfg. Co. will erect a 3-story, 120 x 600-foot mill to be used for spinning and twisting.

FALL RIVER, MASS. — Fyans, Fraser & Blackway Co. has closed its machine repair business, consisting of machine shop equipment, but will continue its textile machinery business in Fall River and in Warren, R. I.

FALL RIVER, MASS.—Bids have closed for a brick, fireproof, 4-story and basement, 72 x 140-foot building to cost $150,000 at the corner of North Main and Elm streets, to be erected by the Masonic lodge.

MALDEN, MASS.—The Malden Gas & Electric Co. will erect a 1-story, 35 x 45-foot meter building.

MONSON, MASS.—A. D. Ellis & Sons are building an addition to their No. 3 plant to be used as a machine shop.

NEWTON, MASS.—The Saco-Lowell shops have started work on a 112 x 144-foot brick, steel and concrete foundry on Oak street.

NORTH ADAMS, MASS.—A contract has been awarded for the Drury high school to cost $255,000.

READVILLE, MASS.—The Stafford Loom Co. will erect a new foundry building which, with other additions, will double the output of its looms.

SOUTH FRAMINGHAM, MASS.—I. Levinstein & Co., Boston, have awarded a contract for a concrete 4-story, 98 x 100-foot oil plant at South Framingham.

SPENCER, MASS.—The Northern Brass Co. is planning and installing machinery in the yeast factory on West Main street, and expects to have one of the largest brass foundries, with factory adjoined, for the making of brass and metal alloy products in the United States or Canada in operation before Feb. 1. About 200 hands will be employed at the start and at full capacity the factory will be large enough to give employment to about 1,000 men. The lower floor will be used as a foundry and the three upper floors for machine shops which will be equipped with stamping, turning, polishing and shaping machines. The company has under consideration offers of a war order amounting to $1,000,000 to make brass castings for shrapnel.

SPRINGFIELD, MASS—The Mevis Motors Co. has been incorporated; $10,000 capital stock; by George A. Mevis, Providence, R. I., E. A. Chappell and J. D. Kaps.

WORCESTER, MASS.—Carl G. Westlund Co., maker of split safety clutches for overhead motors, is planning to build an addition to its Millbury street plant in the spring. The company has orders ahead for about two years.

WORCESTER, MASS. — Stafford Iron Works, Inc., has awarded a contract for a 2-story, 50 x 70-foot wood and concrete addition to be used for its ornamental iron and general iron forging business. The company has taken over the Boston Art Metal Co. and consolidated it with its business in Worcester.

NEWPORT, R. I.—The United States government will build a brick and stone, 2-story and basement post office and custom house to cost $400,000.

WOONSOCKET, R. I.—Lockwood, Greene & Co., Boston, architects and engineers, have prepared plans for extensive additions to the plant of the Nyanza mill which will double the capacity. They include a main mill, picker house and storage building, of brick and steel construction. About 350 tons of structural steel will be required.

BRIDGEPORT, CT.—The Samuel Austin & Sons Co., Cleveland, general contractor, has taken over the factory building at South avenue and Water street as a storehouse for its building material.

BRIDGEPORT, CT.—The Samuel Austin & Sons Co., Cleveland, has been awarded a contract to build a 5-story, 50 x 260-foot brick, steel and concrete machine shop to cost $100,000 for the Bullard Machine Tool Co.

NEW BRITAIN, CT.—The Hart & Cooley Mfg. Co. has started work on a 2-story, 45 x 90-foot and a 3-story, 24 x 51-foot building, to be devoted to the manufacture of registers.

BROOKLYN, N. Y.—The Nelson & Landgren Co., 1220 Sixtieth street, is taking bids on a 1-story, 40 x 80-foot shop building.

BUFFALO, N. Y.—The Buffalo General Electric Co. has plans in progress for an electric generating plant to cost $2,500,000.

BUFFALO, N. Y.—The American Radiator Co. will build an addition to its plant on the New York Central railroad belt line.

BUFFALO, N. Y.—The Buffalo Pattern Works will erect a 2-story factory, 70 x 120 feet, on Hertel avenue at a cost of $25,000. E. Simons is manager of the plant.

BUFFALO, N. Y.—The Delaware, Lackawanna & Western railroad is having plans prepared for a 30 x 85-foot power house to be erected at Buffalo.

LONG ISLAND CITY, N. Y.—The Rome Metallic Bedstead Co., New York, has leased a 3-story building, to be erected by the Degnon Realty & Terminal Improvement Co. on a 100 x 404-foot plot, near Anable avenue and Creek street. The company will move its plant to the new location as soon as the building is finished.

NEW YORK.—The Flameless Heater Co. has been incorporated to build machinery and power-creating devices; $50,000 capital stock; by Sara A. Thorton, A. I. Gardner and David Asch, 925 West End avenue.

ROCHESTER, N. Y.—Rochester Top Lift Co. will build a 2-story factory, 51 x 207 feet, with two wings.

ROCHESTER, N. Y. — The Rochester Stamping Co. will build and equip a factory, 60 x 151 feet.

ROCHESTER, N. Y.—The Rochester Motors Co. is building an addition, 62 x 150 feet, to its factory on Wren street.

ROCHESTER, N. Y.—The T. H. Symington Co. is erecting an addition to its plant at Lincoln Park; the company manufactures railroad specialties.

SCHENECTADY, N. Y. — The General Electric Co. has started work on a 1-story, 60 x 208-foot addition.

DONORA, PA.—The American Steel & Wire Co. will increase the capacity of its rod department by the installation of a new mill, which will be completed in about four months.

JOHNSTOWN, PA. — The Pennsylvania railroad plans to erect a double track bridge over the Conemaugh river. Definite plans for the construction of the structure have not been adopted.

MONONGAHELA, PA. — The Stauffer Chemical Co. has completed plans for the erection of a new chemical laboratory, the general contract for which has been awarded to the George Hogg Co., Pittsburgh.

PHILADELPHIA. — Wm. Cramp & Sons Ship & Engine Building Co. is in the market for a number of machine tools.

PHILADELPHIA.—The General Smelter Co., Richmond and Westmoreland streets, has let a contract for a 1-story, 40 x 60-foot smelter addition.

PHILADELPHIA.—The plant of the Girard Metal & Iron Co., York street and Aramingo avenue, was damaged by fire which originated in the explosion of an oil tank.

PITTSBURGH.—F. J. Osterling, architect, is preparing plans for extensive alterations to the L. A. Meyran building in Fifth avenue.

PITTSBURGH.—The Clairton Steel Co. has purchased four 30 x 120-foot plots near its plant. It is rumored that the company will enlarge its present capacity.

PITTSBURGH.—Plans are being completed for a new freight house for the Pennsylvania railroad, to be erected in East Liberty, at a cost of about $50,000.

PITTSBURGH.—The Westinghouse Electric & Mfg. Co. continues to buy shell making equipment for its plant on Twenty-eighth street, where 8-inch shells are being finished.

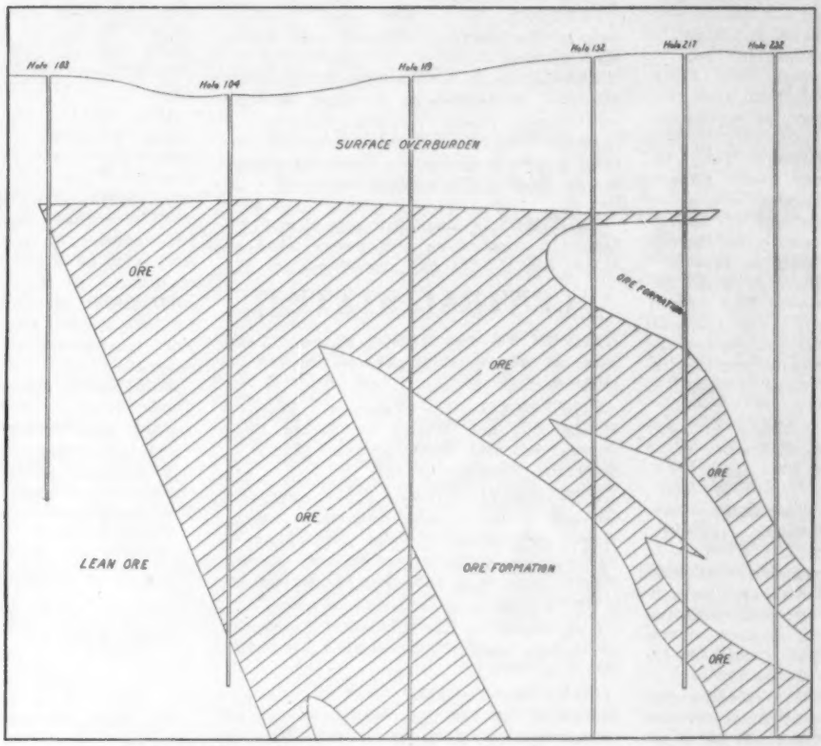
PITTSBURGH. — The Standard Sanitary Mfg. Co., manufacturers of sanitary ware, is considering the opening of a warehouse at Youngstown, O.

PITTSBURGH.—Bids are being received for the construction of a 6-story office and freight warehouse building for the Pittsburgh & Lake Erie railroad to be built at Smithfield and Carson streets at a cost of about $100,000.

PITTSBURGH.—It is reported that a plant to roll seamless steel tubes will be built at Tiltonville, O., near Wheeling, by the American Seamless Tube Co., recently organized with a Pennsylvania charter.

PITTSBURGH. — Allegheny county commissioners are asking bids for furnishing trimble arches, hollow metal doors and metal

IRON ORES



CROSS SECTION SHOWING ORE DEPOSITS OF PENNINGTON MINE ON CUYUNA RANGE

The Pennington is the first open pit mine on the Cuyuna. The first carload of ore was taken out August 2, 1913. Shipments for 1916 will be from 300,000 to 350,000 tons. The ore is non-bessemer of good structure and is especially desirable for basic iron. The average analysis last year was 59.20 per cent iron, dry.

The output of this mine during 1916, together with our other mines, gives us an unusually large tonnage.

We are now taking contracts for this ore and will be glad to figure on your requirements for the coming season.

The Tod-Stambaugh Company

Perry-Payne Building **Cleveland, Ohio**

elevator doors for the city hall and court house.

PITTSBURGH.—W. A. Thomas, architect, is receiving bids for the remodeling of the building at Park Way and Sandusky street occupied by the Allegheny Express Co. The building will be converted into a garage.

PITTSBURGH. — Allegheny county commissioners are asking bids for the construction of a reinforced concrete eliptical arch bridge to span Sewickley creek between Allegheny and Beaver counties.

PITTSBURGH.—John P. Brennan, architect, has completed plans for a 2-story and basement, brick and sandstone, refractory building, to be erected on the city poor farm at Marshalsea, at an estimated cost of $45,000.

PITTSBURGH.—The Keystone Brush & Paint Co., capital stock $10,000, has been incorporated by W. C. Colflesh, 1016 Parker avenue, McKeesport; H. H. Hults, Otto, Pa., and T. F. Soles, McKeesport, to manufacture paints and brushes.

PITTSBURGH.—The National Tube Co. will erect four 80-ton open hearth furnaces and a 40-inch electric blooming mill at its works at Lorain, O. A gas unit will be supplied for the generator. Contracts for the new furnaces will be awarded early in January.

PITTSBURGH.—The Pittsburgh Model Engine Co., with a plant between East Liberty and Homewood stations, may install additional equipment for building small gas engines and automobile parts. The company recently increased its capital stock from $750,000 to $1,500,000.

SHARON, PA.—The Mahoning & Shenango railroad has filed notice at Harrisburg of an increase in the capital stock from $1,000,000 to $3,000,000.

SHARON, PA.—County commissioners have awarded to the Canton Bridge Co., subject to the approval of the court, a contract for a bridge to span the Shenango river at State street. Specifications call for a 2-span through-plate girder bridge, 182 feet long with two circular piers, four feet in diameter in the center of the stream. The Canton Bridge Co.'s bid was $49,990.

UNIONTOWN, PA.—F. P. Truesdale, agent for the Pennsylvania railroad, announces that improvements, costing $240,000, will be undertaken after Jan. 1, a freight house and a warehouse will be erected. The railroad recently purchased considerable property for extensions.

ATHENIA, N. J.—The Athenia Steel Co. will erect a band building, a storehouse and an annealing building.

ELIZABETH, N. J.—Plans are being prepared for the erection of a steel bridge across the Baltic river, to cost $40,000.

ELIZABETH, N. J.—F. L. Schmidt, North avenue, will build a 2-story, 50 x 85-foot shop building.

JERSEY CITY, N. J.—The Joseph Dixon Crucible Co. has let a contract for a 4-story, 100 x 150-foot addition.

JERSEY CITY, N. J.—The Kellogg Repair Sleeve Co. has been incorporated to manufacture cast iron pipe sleeves; $10,000 capital; by R. M. Kellogg, Ridgewood, C. E. Corbin, Rahway and C. K. Corbin, Summit, N. J.

MATAWAN, N. J.—The antimony department of the Magnolia Metal Co. was damaged by fire. The company is manufacturing cartridges.

NEWARK, N. J.—Albrecht Pagenstecher Jr. has been granted a permit to erect a 1-story experimental building in Ball's lane.

NEWARK, N. J.—The Superior Ivory Button Co. has let a contract for a 4-story, 31 x 195-foot addition to its plant at Dickerson and Hecker streets.

NEWARK, N. J.—The American Piston Ring Co., 704 South Eleventh street, has been granted a permit to erect a 1-story brick factory building to cost approximately $12,000.

NEWARK, N. J.—The Eastern Tool & Mfg. Co., of which A. G. Anderson, 74 Richmond street, is president, has plans in progress for the erection of a 1-story, 50 x 180-foot tool factory at Bloomfield, N. J.

NEWARK, N. J. — Gould & Eberhardt, manufacturers of machine tools, contemplate the erection of a factory at Hillside. The present plant is located at 111 New Jersey railroad avenue.

OCEAN GROVE, N. J.—Joel C. Perry, Ocean Grove, Alfred R. Stanger, Philadelphia, and F. Bradley Cox, Asbury Park, have formed the Perry Signal Co. with $100,000 capital and will manufacture an electric signalling device for automobiles and railroads.

TRENTON, N. J.—Fire caused a serious loss at the plant of the American Rubber Manufacturing Co.

TRENTON, N. J.—The Star Porcelain Co. will erect an addition to its plant on Muirheid avenue.

TRENTON, N. J.—The Royal Rubber company will erect a plant on Brunswick avenue, to cost $10,000. The building will be 50 x 150 feet.

BALTIMORE.—The Baltimore Tube Co. has let a contract for two 1-story additions, 21 x 44 and 37 x 172 feet, respectively.

CENTRAL STATES

AKRON, O.—The Mohawk Rubber Co. has increased its capital stock from $250,000 to $500,000.

CINCINNATI.—The Enterprise Brass & Plating Co., now located on Spring Grove avenue, will soon move to new quarters at Sixth and Baymiller streets.

CINCINNATI. — The Fulton-Greuter Mfg. Co. will move to Cincinnati from Saugus, Mass., and locate at Sixth and Baymiller streets. The company manufactures an automobile carbureter, and does a general engineering work.

CLEVELAND.—The National Engineering Co. has increased its capital stock from $10,000 to $30,000.

DAYTON, O.—The American Railways Equipment Co. has been incorporated; $5,000 capital stock; by James C. Dawley, David B. Whistler, Edward C. Reed, Jacob A. Oswald and Edward E. Burkhart.

NILES, O.—The Niles Car & Mfg. Co., builders of interurban trolley cars, will build and equip a department for the manufacture of motor trucks. New equipment will be purchased.

SANDUSKY.—The Ferrel Creek Foundry Co. has tentative plans to double the capacity of its plant.

SPRINGFIELD, O.—The Robbins & Myers Co. is buying equipment for its addition, which will be begun shortly after the first of the year. Bids for the erection of the building will be taken shortly.

WARREN, O.—The Mahoning Steel Products Co. has been incorporated; $50,000 capital stock; by C. C. Stewart and others.

YOUNGSTOWN, O.—The Youngstown Radiator Co. has been incorporated; $25,000 capital stock; by John B. Gabrielson, Sophia Gabrielson, Ernest C. Swanson, C. F. Newgreen, Warren, O.

FORT WAYNE, IND.—The Miller-Lillich Co. has been incorporated to manufacture an automobile anti-skidding device; $100,000 capital stock; Thomas A. Nelson, Emmet G. Reed and Harry Miller.

INDIANAPOLIS, IND.—The Hardy Mfg. Co., Pendleton, was incorporated at $25,000 to manufacture machines and metal products; by T. M., G. M. and R. W. Hardy.

INDIANAPOLIS, IND.—The Keyless Lock Co. has received orders for the interior and grille work for the banking quarters of the State National Bank of Evansville, Ind., and equipment for a new bank at Reno, Nev.

JEFFERSONVILLE, IND.—The Pennsylvania railroad will build a bridge over the Ohio river between Jeffersonville and Louisville at an estimated cost of $2,500,000.

ORLEANS, IND.—A water works system is being planned at a cost of $50,000.

BLOOMINGTON, ILL.—The Scofield Heater Co. is considering the erection of a factory to cost $25,000.

OTTAWA, ILL.—A bond issue for $85,000 has been voted for building the Shippensport bridge.

ROCKFORD, ILL.—Bids will be received until Jan. 26 by H. J. Gallagher, chairman street and alley committee, for a reinforced concrete bridge, 400 feet long, with one approach 500 feet long. An alternate bid for a steel span with a concrete approach is asked.

ADA, MICH.—The county commissioners, Grand Rapids, are considering building a steel bridge over Grand river at Ada, to cost $30,000.

DETROIT.—The Huff Laboratories have been incorporated to build gasoline and electric engines and appliances; $20,000 capital stock; by Orvice LaBounty, Harry L. Cunningham, E. S. Huff.

JACKSON, MICH.—The Hupp Motor Car Co. will buy the plant of the American Gear Mfg. Co., which will be enlarged and improved.

MUSKEGON, MICH.—J. R. Chesley and Frank Broscha, of Danville, Ill., are considering the erection of a foundry at Muskegon to manufacture steam injectors.

MUSKEGON, MICH.—Glen H. Howe is organizing a company to take over a plant at Muskegon to make tire chains.

SPARTA, MICH.—The Sparta Foundry Co. is building an addition to its plant. E. P. Bradstrum is the general manager of the concern.

ANTIGO, WIS.—The plant of the International Hoist Co., Antigo, which recently was purchased at foreclosure sale by J. C. Wright, of Antigo, is again accepting orders for hoists and machinery. It is likely that J. C. Wright will organize a company to take over the property for further development.

CHIPPEWA FALLS, WIS.—Plans have been accepted by the Chippewa county board for a steel bridge, four spans, 750 feet long, to cost $75,000.

GREEN BAY, WIS.—The Chicago & North-Western railroad is stated to have finally made a decision to establish car and repair shops at Green Bay, Wis. The matter has been pending about three years. The work is to be done during 1916.

MILWAUKEE. — The Wisconsin Iron & Wire Works has increased its capital stock from $30,000 to $80,000.

MILWAUKEE.—The Chicago, Milwaukee & St. Paul railroad has been ordered by the court to rebuild the Grand avenue viaduct.

MILWAUKEE.—The United States Electric Tool Co. has been incorporated; $25,000 capital stock; by E. J. Ramler, Frank Kraemer and John Zeman.

MILWAUKEE. — The Universal Machinery Co., 1916 St. Paul avenue, is building a machine shop of reinforced concrete and steel, one story, 120 x 120 feet; Herbert & Huffschmidt, Casswell block, architects.

MILWAUKEE. — Herbst & Hufschmidt, architects, 721 Caswell block, are ready for bids for two 5-ton electric traveling cranes, one for the shop of the Advance Engineering Co. at North avenue and Thirtieth street, and the other for the foundry of the Jaeschke Bros. Foundry Co., Cawker place and Thirtieth street. Both works are in process of erection.

MILWAUKEE.—The Fitzsimmons Steel &

Iron Co., Chicago, recently incorporated in Milwaukee, purchased a 200 x 275-foot site on Park street between Fifth and Sixth avenues. This site has both railroad and dock facilities. Work on the erection of a building will be started shortly. The company will manufacture cold drawn steel products. Carl and Ernest Prinz, Milwaukee, are interested.

MILWAUKEE, WIS.—Provision is being made in the city budget for a bond issue of $750,000 for the purpose of constructing a street lighting distribution system, which is to constitute a part of the municipal electric lighting plant. The plans have been prepared by Vaughan, Meyer & Sweet, electrical engineers, Majestic building. Fred G. Simons is commissioner of pubic works.

RACINE, WIS.—The plant and stock of the Hamilton-Beach Mfg. Co., electrical devices, Racine, was damaged by fire. Temporary repairs will be made until occupancy is taken of the plant the company is now building in Racine.

RACINE, WIS.—Matthew Mares, 1303 Frederick street, Racine, who recently has been granted patent on several farm implements and devices, is planning to organize a company to manufacture the articles. Mr. Mares has been associated with the J. I. Case Plow Co., Racine, for more than twenty-five years.

RICE LAKE, WIS.—A site has been purchased by the Rice Lake Motor Co. for a garage and machine shop, to be 66 x 132 feet, one and two stories, of fireproof construction.

SHEBOYGAN, WIS.—The Minneapolis Machine Co. will build a 2-story addition to its machine shop, 70 x 75 feet.

WAUKESHA, WIS.—The Federal Bridge Co., which some time ago began the manufacture of farm tractors for outside concerns, has booked an order for building 300 machines of this type for the Nillson Farm Machinery Co., Minneapolis.

ST. LOUIS, MO.—The Cox Mfg. Co. has been incorporated to manufacture chemicals of all kinds; $5,000 capital stock; by John C. and Berthold B. Cox, Walter F. Wilsdorf.

FORT MADISON, IA.—The Larson Ice Machine Co. will let a contract for a factory 40 x 150 feet, of brick and steel.

MANKATO, MINN.—Plans are being prepared for a reinforced concrete arch bridge of five spans of 90 feet each over Minnesota river, by D. D. Price, engineer, Lincoln, Neb.

ST. PAUL.—The Chevrolet Motor Car Co. will build a 4-story steel and brick factory and assembling plant costing $500,000.

ST. PAUL.—Bids will be received until Jan. 17 by August Hohenstein, city purchasing agent, for a steam pumping unit with a capacity of 15,000,000 gallons per 24 hours against a combined head of 171 feet. Also desires centrifugal type pump driven by steam turbine through reduction gear. The pump is to be driven by a vertical triple expansion engine.

SOUTHERN STATES

NEWPORT NEWS, VA. — The Newport News Ship Building & Dry Dock Co. has out inquiries for a few machine tools.

CLARKSVILLE, TENN.—The Red River Iron Works has been incorporated; $40,000 capital stock; by Graham MacFarlane, N. H. Leech and M. S. MacFarlane.

SHERIDAN, ARK.—Grant county will build a 130-foot steel bridge over Salime river. Address the county judge.

DALLAS, TEX.—The Texas Keystone Steel & Wire Co. has been incorporated; $20,000 capital stock; by H. G. Moore, P. W. Sommer, L. E. Burgess and others.

KENEDY, TEX.—The Kenedy Light Co. will install a 75-kilowatt generator.

MARSHALL, TEX.—C. H. Chamberlain, Dallas, is preparing plans for shops for the Texas & Pacific railroad to replace those recently damaged by fire.

ORANGE, TEX.—The Letcher & Moore Lumber Co. will build a 35-mile railroad and desires bids. Line will be an extension of the Gulf, Sabine & Red River railroad.

BARTLESVILLE, OKLA.—The Bartlesville Salvage Machine & Supply Co. has been incorporated; $20,000 capital stock; by M. Modell, I. Morrison and L. Morrison.

SAND SPRINGS, OKLA.—The Osage Iron Co., organized by Barney Smith, of the Texas Rolling Mill Co., Fort Worth, and others, will build a plant to roll reinforcing rods, spikes and bar iron. Machinery to be electric driven. Capacity of the plant will be about 20 tons daily.

WELCH, OKLA.—Waterworks and electric light plants are to be built, bonds of $32,000 having been voted. S. M. Booton is city clerk.

WESTERN STATES

LINCOLN, NEB.—Bids will be taken soon on a steel or concrete bridge over South Platte river, costing $30,000.

CULBERTSON, MONT.—Donaldson Bros., owners of the local electric light plant, will make extensive improvements to carry additional current for street lights.

TUCSON, ARIZ.—Bids will be received until Jan. 15 by L. O. Cowan, city clerk, for a reinforced concrete bridge over Santa Cruz river and the removal of the present steel structure.

CALDWELL, IDA.—Business men have decided to assume the responsibility for floating a $25,000 bond issue for the Caldwell traction company. The proceeds will be used in electrifying the Wilder branch of the Oregon Short line.

BREMERTON, WASH.—The sum of $7,854 has been allotted to the Puget Sound navy yard for improvements in the pattern shop, including the radio and electric shop.

CHEHALIS, WASH.—Lens county commissioners ask plans for a 210-foot steel span over the Cowlitz river.

EVERETT, WASH.—F. L. Hammond has filed a claim with the county auditor for a power site in the Sultan river to be used for mining, power site and electric power.

SEATTLE, WASH.—Chief Engineer West of the port of Seattle commission has made an estimate which shows that construction of the interbay, Ballar-Fremont and East Marginal way units of the port commission's proposed belt line together with purchase of a car ferry would cost $348,000.

SPOKANE, WASH.—The Washington Water Power Co. has been awarded a contract for an ornamental lighting system on Trent avenue.

RANIER, WASH.—The Lindstrom & Handforth Lumber Co., Tacoma, will begin at once the reconstruction of its mill at Ranier which was damaged by fire. The cost will be about $40,000.

WENATCHEE, WASH.—Plans and specifications are being prepared by Fred. A. Warren, county engineer, for a steel bridge over the Wenatchee river.

WENATCHEE, WASH. — It is reported that the Great Northern railroad will begin the construction of a branch line this spring. It is also reported that the Great Northern will electrify its line through the Cascade mountains and Wenatchee-Oroville line during the coming year.

CORVALLIS, ORE. — The council has passed a franchise for the Southern Pacific railroad company and the work of electrification between Corvallis and Whiteson will start shortly.

PORTLAND, ORE.—The council has granted permission to the Portland & Oregon City railroad to issue bonds for $350,000 for the completion of a road between Portland and Oregon City.

PORTLAND, ORE.—The Southern Pacific has placed orders for the steel to be used in the construction of the Holgate street viaduct. This viaduct will include four 75-foot spans with concrete abutments. The estimated cost is $50,000. H. M. Lull, Union depot, is the district engineer.

ROSEBURG, ORE.—The council is taking steps to hasten the sale of $300,000 in bonds to aid in the construction of the Roseburg-Umpqua railroad.

SANTA BARBARA, CAL.—Plans are being prepared by A. V. Saph, Berkeley, Cal., for a bridge over the Santa Ynez river, costing $100,000 to $125,000. The state will pay $75,000 on the project.

CANADA

CALGARY, ALTA.—The Edmonton Power Co., Ltd., is planning a 1500-foot concrete dam, 100 feet high, on the Saskatchewan river above Rocky Rapids. An artificial lake will be created having an area of about 60 square miles. Electricity will be generated and brought to Edmonton on steel-tower transmission lines and stepped down in a substation for use in the city. It is estimated that the project will cost about $6,000,000 exclusive of an electric railroad which will be built from Edmonton to the power site. The building of the plant, dam and railroad will take about four years. It is planned to have the railroad make tributary to Edmonton farming, timber and pulp wood districts in the vicinity.

VANCOUVER, B. C.—The Canadian Pacific railroad proposes to install a 50-ton electric crane.

ST. CATHERINES, ONT.—Fire did about $150,000 to $200,000 damage to the plant of the Maple Leaf Milling Co. The company has been making extensive shipments of flour abroad.

TORONTO, ONT.—The Three-O-System Co. has been incorporated to manufacture furnaces and stoves; $250,000 capital stock; by Frederick H. Barlow, Ethel A. Douglass and Ina M. Johnston, all of Toronto.

TORONTO, ONT.—The Canadian Steel & Brass Products Co. has been incorporated to manufacture munitions, tools and machinery; $500,000 capital stock; by Albert Ogden, Allington B. Bowlby and Gertrude Prior.

TORONTO, ONT.—The Electric Welding Co. has been incorporated to manufacture machinery and mechanical appliances of all kinds; $40,000 capital stock; by William H. Irving, Henry H. Davis and John R. Rumball.

TORONTO, ONT.—The Hay River Coal Co. has been incorporated to conduct a coal mining business; $100,000 capital stock; by Gerald Rud, Archibald J. Reid and Samuel P. Briggs, Toronto, the latter representing the Mackenzie & Mann interests.

TORONTO, ONT.—The G. H. Tod Co. has been incorporated to carry on business as engineer, contractor and metal founder; $40,000 capital stock; by Bruce E. Ingham, George H. Tod and Ethel M. Brown, all of Toronto.

TORONTO, ONT.—The International Steel Corporation has been incorporated to manufacture iron and steel and other metals; $100,000 capital stock; by James R. Roaf, William Graham and John E. Morgan, Toronto.

MONTREAL, QUE.—The Canadian Electrode Co., Ltd., has been incorporated to manufacture metals, chemicals and by-products; $100,000 capital stock; by Howard Murray, William S. Hart and Julian C. Smith, all of Montreal.

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

(Delivery April 1.)

Bessemer, valley	$20.00
Bessemer, Pittsburgh	20.95
Basic, Pittsburgh	18.95 to 19.45
Basic, eastern Pa.	18.00 to 18.50
Basic, Buffalo	20.00
Malleable, Pittsburgh	19.45 to 19.95
Malleable foundry, Chicago	18.50
Malleable foundry, Philadelphia	20.50 to 20.75
Malleable foundry, Buffalo	18.00 to 19.00
No. 1X foundry, Philadelphia	20.50 to 20.75
No. 2 foundry, Pittsburgh	19.45 to 19.95
No. 2 foundry, Cleveland	19.30
No. 2 foundry, Ironton	18.00
No. 2 foundry Chicago	18.50
No. 2X foundry, Philadelphia	19.75 to 20.50
No. 2X fdy., N. J. tidewater	19.75 to 20.50
No. 2X foundry, Buffalo	17.50 to 18.50
No. 2 plain, Philadelphia	19.25 to 19.75
No. 2 plain, N. J. tidewater	19.25 to 19.75
No. 2 plain, Buffalo	17.00
No. 2 southern, Birmingham	14.50 to 15.00
No. 2 southern, Cincinnati	17.40 to 17.90
No. 2 southern, Chicago	18.50 to 19.00
No. 2 southern, Phila. delivery	19.50 to 20.00
No. 2 southern, Cleveland	18.50 to 19.00
No. 2 south'n, New York docks	18.00 to 18.50
No. 2 southern Boston, docks	17.25 to 17.75
No. 2 south. interior, New Eng.	18.50 to 19.50
No. 2 southern, St. Louis	18.40 to 18.90
Virginia No. 2X furnace	17.00 to 18.00
Virginia 2X, Philadelphia	19.75 to 20.75
Virginia 2X, Jersey City	20.00 to 21.00
Virginia 2X, Boston points	20.25 to 21.25
Gray forge, eastern Pa.	17.50 to 18.00
Gray forge, Pittsburgh	18.45
Gray forge, Birmingham	10.50
Silveries, 8 per cent, Jackson, O.	25.00
Silveries, 8 per cent, Chicago	25.50 to 26.50
Low phos. Standard, Phila.	30.50 to 32.50
Low phos. Lebanon, Pa.	29.00 to 31.00
Low phos., Pittsburgh	30.00 to 31.00
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	19.25 to 22.25
Charcoal, Buffalo	19.00 to 20.00
Charcoal, Birmingham	21.50

IRON ORE

Lake Superior Ores.
(Lower Lake Ports.)

Old range Bessemer, 55 per cent, ton	$4.45
Mesabi Bessemer, 55 per cent, ton	4.20
Old range non-Bessemer, 55 per cent, ton	$4.50
Mesabi non-Bess., 51½ per cent, ton	3.55

Eastern Ores.
(Per unit delivered eastern Pennsylvania.)

Pt. Henry fur., 60 per cent, unit.	8.6c to 8.9c
Local N. Y. & N. J. ores, unit.	8.5c to 8.75c
Port Henry lump, at mines, ton.	$4.00

Foreign Ores.
(Per unit Philadelphia.)
(Prices nominal.)

Foreign Bess., 50 to 65 per cent	8 to 8½
For'n non-Bess., 50 to 65 per cent	8 to 8½

COKE

(At the ovens.)

Connellsville furnace	$3.50 to 3.75
Connellsville fur., contract	2.35 to 2.50
Connellsville foundry	3.75 to 4.00
Connellsville fdy. contract	3.00 to 3.25
Wise county furnace	2.85 to 3.10
Wise county foundry	3.25 to 3.50
Pocahontas furnace	2.75 to 3.00
Pocahontas foundry	3.00 to 3.25
New River, foundry	3.25 to 3.75
New River, furnace	3.00 to 3.25

FERRO ALLOYS AND STEEL MAKING METALS

Ferro mang., delivered (prompt)	$110
Ferro mang., Balti., (future)	110
Spiegeleisen 20 per cent, furnace	28.00
Ferro-silicon, 50 per cent, Pbgh.	83.00 to 85.00
Ferro-silicon, 50 per cent, Phila.	83.00 to 85.00

Bessemer ferro-silicon, 9 per cent to 10 per cent, $27.00; 10 ot 11 per cent, $28.00; 11 to 12 per cent, $29.00; 12 to 13 per cent, $30.00 a ton at the furnace at Ashland, Jackson and New Straitsville, O.

Ferro-chrome, 4 to 6 per cent carbon, 25 cents per pound; 2 per cent carbon, 45 cents per pound, delivered.

Ferro-vanadium, $3.15 per pound of contained alloy, Pittsburgh.

Ferro-carbon titanium, 8 to 12½ cents per pound in carloads.

Nickel, 50 to 55 cents per pound.

Ferro-tungsten, nominal.
Cobalt metal, nominal, Pittsburgh.
Aluminum, 59 to 60 cents per pound, New York.
Ferro-molybdenum, Pittsburgh, nominal.

Freight Rates via Panama Canal

Rates on finished materials, including plates, shapes, bars, wire, nails, etc., to Pacific coast points via Panama canal, per 100 lbs., in carload lots, exclusive of insurance and dockage.

From New York	$0.40
From Pittsburgh	.619
From Youngstown	.619
From Niles	.619
From Wheeling	.619
From Steubenville	.619
From Johnstown	.604
From Coatesville	.545
From Steelton	.555
From Bethlehem	.529
From Cleveland	.65
From Chicago	.765

SEMI-FINISHED MATERIAL

Open hearth billets, Phila.	$38.00 to 40.00
Bessemer billets, Phila.	33.00 to 35.00
Forging billets, Phila.	50.00 to 55.00
Forging billets, Pbgh. (nominal)	55.00
Forging billets, Chgo.	40.00 to 45.00
Wire rods, Pittsburgh (nom.)	40.00
Bess. bill., Youngstown	33.00 to 34.00
Open hearth billets, Youngstown	34.00 to 35.00
Bessemer billets, Pittsburgh	33.00 to 34.00
Open hearth billets, Pittsburgh	34.00 to 35.00
Bess. sheet bars, Youngstown	33.00 to 34.00
Op. h'th sheet bars, Youngstown	34.00 to 35.00
Bess. sheet bars, Pittsburgh	33.00 to 34.00
Op. h'th sh. bars, Pbgh	34.00 to 35.00
Muck bar, Pittsburgh (nominal)	34.00

RAILS AND TRACK MATERIAL

Stand. Bess., rails, Pbgh. & Chg.	1.25c
Stand. op-h'th rails, Pbg. & Chg.	1.34c
Light rails, 8 to 10 lbs., Pbgh.	1.70c
Light rails, 8 lb. Chgo.	1.58c
Light rails, 12 to 14 lbs., Pbgh.	1.65c
Light rails, 12 lbs., Chgo.	1.53c

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—

Cleveland	$0.95
Newark, N. J.	2.98
Boston	3.18
Philadelphia	2.78
Pittsburgh	.95
St. Louis	3.18

Buffalo to:—

Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York and Brookyln (by canal)	1.25 to 1.60

Virginia furnaces to:—

Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88

Birmingham, Ala., to:—

Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky	2.65
New York (all rail)	6.15
New York (rail and water)	4.25
Philadelphia (all rail)	5.20
Philadelphia (rail and water)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75

Chicago to:—

Des Moines	$2.80
Milwaukee	.50
Moline, Ill	1.40
Omaha	3.58
St. Louis	1.58

Ironton and Jackson, O., to:—

Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

Light rails 16 to 20 lbs., Pbgh.	1.60c
Light rails 16 to 20 lbs., Chgo.	1.48c
Light rails 25 to 45 lbs., Pbgh.	1.55c
Light rails 25 to 45 lbs., Chgo.	1.43c
Relaying rails, standard, Pbgh. & Chgo.	$23.00 to 24.00
Relaying rails, light, Chgo.	21.50 to 22.50
Angle bars, st. sect., Pbgh. base.	1.50c to 1.75c
Angle bars, st. sections, Chicago	1.50c to 1.75c
Spikes, railroad, Pbgh.	2.10c
Spikes, railroad, Chgo.	2.10c
Track bolts, Pbgh.	2.50c
Track bolts, Chgo.	2.50c to 2.60c
Tie plates, Chgo.	36.00

SHAPES, PLATES AND BARS

Structural shapes, Pbgh.	1.80c to 2.00c
Structural shapes, Chgo.	1.99c to 2.19c
Structural shapes, Philadelphia.	1.959c to 2.159c
Structural shapes, New York.	1.969c to 2.169c
Struc. shapes, San Francisco.	2.00c to 2.05c
Tank plates, Chgo.	1.99c to 2.19c
Tank plates, Pittsburgh.	1.80c to 2.00c
Tank plates, Philadelphia.	1.959c to 2.409c
Tank plates, New York.	1.969c to 2.419c
Bars, soft steel, Pittsburgh.	1.80c to 2.00c
Bars, soft steel, Chgo.	1.99c to 2.19c
Bars, soft steel, Philadelphia.	1.959c
Bars, soft steel, New York.	1.969c
Hoops, carloads, Pittsburgh.	2.00c
Bands, Pittsburgh	1.80c
Shafting, Pbgh., contr. carloads	45 to 50 off
Bar iron, Chgo.	1.75c to 1.80c
Bar ron, Philadelphia	2.059c
Bar iron, New York	2.069c
Bar iron, Cleveland	1.80c
Bar iron, Pittsburgh	1.90c
Hard steel bars, Chicago.	1.80c to 1.85c

SHEETS AND TIN PLATE

No. 28, black, Pittsburgh.	2.60c to 2.75c
No. 28, black, Chgo.	2.69c to 2.94c
No. 28, tin mill, black, Pbgh.	2.50c
No. 28, galvanized, Pbgh.	4.75c to 5.25c
No. 28, galvanized, Chgo.	5.19c
No. 10, blue anl'd, Pbgh.	2.25c
No. 10, blue anl'd, Phila.	2.559c to 2.569c
Tin plate, 100 lb., coke base.	$3.60 to 3.75

EXTRAS FOR SHEET OR TIN MILL SPECIFICATIONS

(Per hundred pounds.)

Single picked, cold roll. and re-anld.	30 cents
Hot roll'd pick'd and anl., tin mill.	25 cents
Full pickled, cold rolled and re-anld.	50 cents
Auto sheets	75 cents
Blued stove pipe stock	10 cents
Range steel	30 cents
Re-squaring	10 cents
Roller leveling	10 cents
Patent leveling and re-squaring	35 cents
Oiling sheets	10 cents
Deoxiding	10 cents
Lime finish	10 cents
Open-hearth stamping steel, free fr. mill scale	55 cents
Special open hearth deep stpg. steel free from mill scale	80 cents
Extra deep special auto body stock.	$1.25
Ext. for 28 gage ov. 32 to 36-in. wide	10 cents

No reduction for sheets not annealed.

The above extras apply on both sheet and tin mill specifications, at the same rate.

IRON AND STEEL PIPE

(Pittsburgh.)

	Black. Butt-weld.	Galv. Butt-weld.
Steel, ⅜ to 3 inches	78	63½
Iron, ¾ to 2½ inches	70	52
	Lap-weld.	
Steel, 2½ to 6 inches	77	62½

BOILER TUBES

Steel, 3½ to 4½ inches l. c. l.	68
Iron, 3½ to 4½ inches l. c. l.	56

WIRE PRODUCTS

(Retailers' price 5 cents above jobbers' quotation.)

Wire nails, jobbers, Pittsburgh.	$2.10
Plain wire, jobbers, Pittsburgh.	1.95
Galvanized wire, jobbers, Pbgh.	2.65
Polished staples, Pbgh.	2.25
Galvanized staples, Pbgh.	2.95
Barb wire, painted, jobbers, Pbgh.	2.25
Barb wire, galv., jobbers, Pbgh.	2.95

IRON AND STEEL PRICES

Corrected up to Tuesday noon

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller or shorter, rolled threads, 70 and 12½; cut threads 70 and 5; larger or longer, 65.

Machine bolts with hot pressed nuts, ⅜ x 4 inches, smaller or shorter, rolled 70, 10 and 7½; cut, 70 and 12½; larger or longer, 65 and 10.

Gimlet and cone point lag bolts, 75 and 15.

Hot pressed square, blank or tapped nuts, $4.50 off list; hot pressed hexagon blank or tapped, $4.70.

Cold pressed square, blank or tapped, $4.50 off; hexagon, blank or tapped, all sizes, $5.70.

RIVETS

Structural rivets, Pbgh	2.50c
Structural rivets, Chgo. delivery	2.55c
Boiler rivets, Pbgh	2.60c
Boiler rivets, Chgo. delivery	2.65c

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	1.85c

STANDARD STEEL CHAIN.

Chain, ⅜ inch proof coil	3.65c to 3.75c

COLD ROLLED STRIP STEEL

(Subject to regular extras.)

0.10 to 0.19 Carbon.	Base price Cut to length	
1½ inch and wider.	Hard.	Soft.
0.100 and thicker	3.60	3.85
0.050 to 0.099 inc	3.70	3.95
0.035 to 0.049 inc	3.85	4.10
0.031 to 0.034 inc	4.20	4.50
0.025 to 0.030 inc	4.35	4.75
0.020 to 0.024 inc	4.55	4.95
0.017 to 0.019 inc	5.45	5.95
0.015 and 0.016	5.85	6.35
0.013 and 0.014	6.70	7.20
0.012	7.30	7.80
0.011	7.65	8.15
0.010	8.00	8.50
	Coils.	
0.100 and thicker	3.50	3.75
0.050 to 0.099 inc	3.55	3.80
0.035 to 0.049 inc	3.70	3.95
0.031 to 0.034 inc	3.85	4.25
0.025 to 0.030 inc	3.95	4.35
0.020 to 0.024 inc	4.05	4.45
0.017 to 0.019 inc	4.25	4.85
0.015 and 0.016	4.75	5.25
0.013 and 0.014	5.45	5.95
0.012	5.80	6.30
0.011	6.15	6.65
0.010	6.50	7.00

CAST IRON WATER PIPE

Four-inch, Chicago	30.00
Six-inch and larger, Chicago	28.00
Six-inch Class B, New York	26.50 to 27.00
Four-inch, Class B, New York	29.00 to 30.00
Four-inch, Birmingham	25.00
Six-inch and larger, Birmingham	23.00

Light weight water and gas pipe, $1 per ton higher than standard water.

WAREHOUSE PRICES

Steel bars, Chicago	2.30c
Steel squares, 2-in. & ov., Cleve.	2.65c
Steel rounds, 2 in. and over	3.00c
Steel bars, under 2-in., Cleveland	2.50c
Steel bars, Cincinnati	2.45c
Steel bars, Philadelphia	2.40c to 2.60c
Steel bars, New York	2.40c to 2.45c
Steel bars, St. Louis	2.35c
Steel bars, St. Paul	2.40c
Steel bars, over 2-inch, Buffalo	3.15c
Steel bars, Buffalo	2.45c
Iron bars, Chicago	2.30c
Iron bars, Cleveland	2.45c
Iron bars, St. Louis	2.20c
Iron bars, Cincinnati	2.35c
Iron bars, Philadelphia	2.40c
Iron bars, New York	2.30c to 2.35c
Hoops, Chicago	2.15c
Shapes and plates, Chicago	2.40c
Shapes and plates, Cleveland	2.50c
Shapes and plates, Buffalo	2.45c
Shapes and plates, Cincinnati	2.40c
Shapes and plates, St. Louis	2.40c
Shapes and plates, Philadelphia	2.40c
Shapes, New York	2.40c
Plates, New York	2.50c
Shapes and plates, St. Paul	2.45c
No. 10 blue anl. sheets, Chgo	2.70c
No. 10 blue anl. sheets, Clevel'd	2.65c
No. 10 blue anl'd sheets, Buffalo	2.70c
No. 10 blue anl. sh., St. Louis	2.70c
No. 10 blue anl. sheets, Cinci	2.65c to 2.70c
No. 10 blue anl. sheets., St. Paul	2.75c
No. 28 black sheets, Chgo	2.90c
No. 28 black sheets, Cleveland	2.95c
No. 28 black sheets, Cincinnati	3.00c
No. 28 black sheets, St. Louis	3.00c
No. 28 black sheets, St. Paul	3.00c
No. 28 galv. sheets, Chgo	4.80c to 5.00c
No. 28 galv. sheets, Cleveland	5.25c
No. 28 galv. sheets, Cincinnati	5.25c
No. 28 galvanized sheets, St. L.	5.10c

Freight Rates, Coke

Connellsville district, per 2,000 lbs., to:—	
Baltimore	$1.80
Buffalo	1.85
Chicago	2.50
Cleveland	1.60
Detroit	2.10
East St. Louis	2.80
Joliet	2.50
Louisville	2.50
Milwaukee	2.85
New York	2.85
Philadelphia	2.05
Pittsburgh	.75
Richmond, Va.	2.94
Toledo	1.85
Valley Furnaces	1.20
Cincinnati	2.00

IRON AND STEEL SCRAP

(Net Tons.)

No. 1 railroad wrought, Chgo	$15.50 to 16.00
No. 1 railroad wrought, Cleve	14.50 to 15.00
No. 1 railroad wrought, St. L	15.00 to 15.50
No. 1 railroad wrought, Cinci	12.25 to 12.75
No. 2 railroad wrought, Chgo	14.50 to 15.00
No. 2 railroad wrought, St. L	14.75 to 15.00
Arch bars and transoms, Chgo	17.50 to 17.75
Arch bars and transoms, St. L	16.50 to 17.00
Knuckles, coup., Chgo	14.50 to 15.00
Springs, Chgo.	16.25 to 16.50
Knuckles, coup. & spr'gs, St. L.	14.50 to 15.00
Shafting, Chgo.	17.25 to 17.75
Shafting, St. Louis	16.00 to 16.50
Steel car axles, Chicago	21.75 to 22.25
Steel car axles, St. Louis	22.00 to 23.00
Locomotive tires, Chicago	15.50 to 16.00
Locomotive tires, St. Louis	15.00 to 15.50
Cut forge, Chicago	14.75 to 15.00
Pipes and flues, Chicago	12.00 to 12.25
Pipes and flues, Clevel'd (nom.)	11.25 to 11.75

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 lbs. to:—

New York	16.9 cents
Philadelphia	15.9 cents
Boston	18.9 cents
Buffalo	11.6 cents
Baltimore	15.4 cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Minneapolis and St. Paul	32.9 cents
Denver	68.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast, (all rail)	73.9 cents
Pacific coast, (tin plate)	70 cents
Pacific coast, via Panama canal	61.9 cents

Pipes and flues, St. Louis	10.50 to 11.00
No. 1 cast, Chicago	13.00 to 13.50
No. 1 cast, Cleveland	12.50 to 13.00
No. 1 cast, Cincinnati	11.50 to 12.00
No. 1 cast, St. Louis	9.50 to 10.00
No. 1 busheling, Chicago	13.25 to 13.50
No. 1 busheling, Cleveland	13.75 to 14.25
No. 1 busheling, Cincinnati	10.00 to 10.50
No. 1 busheling, St. Louis	11.50 to 12.00
No. 2 busheling, Chicago	9.25 to 9.75
No. 1 boiler plate, cut, Chgo	10.50 to 11.00
No. 1 boiler plate, cut, St. L	7.00 to 7.50
Boiler punchings, Chicago	13.00 to 13.50
Cast borings, Chicago	8.00 to 8.25
Cast borings, Cleveland	7.25 to 7.50
Cast borings, Cincinnati	7.50 to 8.00
Cast borings, St. Louis	7.50 to 8.00
Machine shop turnings, Chgo	8.50 to 9.00
Machine shop turnings, Cleveland	6.75 to 7.00
Machine shop turnings, Cinci	$ 7.00 to 7.50
Machine shop turnings, St. L	8.00 to 8.50
Malleable agricultural, Chgo	11.50 to 11.75
Malleable agriculture, St. Louis	11.00 to 11.50
Malleable railroad, Chicago	14.00 to 14.25
Malleable, Cincinnati	8.00 to 8.50
Malleable railroad, St. Louis	12.50 to 13.00
Angle bars, iron, Chicago	17.25 to 17.50
Angle bars, iron, St. Louis	15.50 to 16.00
Angle bars, steel, Chicago	14.00 to 14.50
Angle bars, steel, St. Louis	14.00 to 14.50
Stove plate, Chicago	10.50 to 10.75
Stove plate, Cleveland	9.75 to 10.00
Stove plate, Buffalo	9.50 to 10.00
Stove plate, Cincinnati	8.00 to 8.50
Stove plate, St. Louis	10.00 to 10.50
Bundled sheet, Cincinnati	8.50 to 9.00

(Gross tons.)

Heavy melting steel, Pbgh	$17.50 to 18.00
Heavy melting steel, Buffalo	16.50 to 17.00
Heavy melting steel, Chicago	15.50 to 16.00
Heavy melting steel, Cleveland	15.25 to 15.75
Heavy melting steel, Cincinnati	14.50 to 15.00
Heavy melting steel, eastern Pa.	16.00 to 16.50
Heavy melting steel, New York	13.50 to 14.00
Heavy melting steel, St. Louis	16.00 to 16.50
Grate bars, Buffalo	11.00 to 11.50
Grate bars, N. J. points	11.00 to 11.25
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Shafting, eastern Pa.	21.50 to 22.50
Wrought pipe, New York	14.00 to 14.50
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Mch. shop turnings, eastern Pa.	11.50 to 12.00
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Cast borings, New York	9.50 to 10.00
Cast borings, eastern Pa.	11.50 to 12.00
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Cast borings, Pittsburgh	10.75 to 11.25
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Stove plate, Pittsburgh	10.50 to 11.00
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Shoveling steel, Chicago	15.25 to 15.50
Shoveling steel, St. Louis	14.50 to 15.00
Reroll. rails, 5 ft & ov., Pbgh	17.75 to 18.25
Reroll. rails, 5 ft. & ov., Chgo	17.50 to 18.00
Reroll. rails, 5 ft. & ov., Cleve.	15.50 to 16.00
Reroll. rails, 5 ft. & ov., E. Pa.	18.00 to 19.00
Reroll. rails, 5 ft & ov., St. L.	17.00 to 18.00
Steel rails, short, Chicago	15.75 to 16.25
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Iron rails, Buffalo	17.00 to 17.50
Iron rails, Cincinnati	14.00 to 14.50
Iron rails, St. Louis	16.00 to 16.50
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Car wheels, St. Louis	14.50 to 15.00
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The Pacific Coast Iron Situation

(*Continued from page* 1276)

original unaltered limestone. While I am not prepared to discuss thoroughly the phenomena involved, my impression is that the original limestones are calcitic, and that ascending heated waters, following the intrusion of the monzonite, decomposed its ferro-magnesian members, deposited the iron as a replacement of the limestone near the contact, and dolomitized the limestones between the contact and the dike *BC*. But the reason of the different action east of the dike *BC* I leave to those better qualified to determine. In the eastern area are a number of vertical faults, some of great length and some short, nearly all of them showing a slight mineralization, chiefly of copper minerals in calcite veins, the gold and silver contents being negligible. Unfortunately the work done on these veins has not been productive; otherwise a fuller study would, perhaps, have been made of the conditions I have indicated above. The only working mine in the immediate region is situated nine miles northeast of Fooshay pass on the same contact, modified by some pegmatic dikes, at what was formerly known as the Bonanza King mine, where several million dollars worth of silver ores were extracted from irregular bodies in the limestones.

Recommends Uniform Cost System

(*Continued from page* 1279.)

good salaries to the heads of their various operating departments, but they hesitate at a proportionate outlay for an intelligent accountant, estimator or clerk, however he may be designated. It also is unfortunate that foundrymen only boast of tonnage records and rarely refer to their best months by profits regardless of the tonnage produced.

In carrying out this system, it is by no means necessary to obtain costs on all small orders, job lots, etc. However, large orders can easily be estimated, followed through the shop and checked and can be properly priced as a basis for an estimate for the next inquiry. This record of any past production also will give the number of castings made per day. Another feature of this method is that today it can be applied on any order made months ago, provided the number of castings molded per day, as well as the weight of such castings, has been recorded.

It is not necessary to tabulate the cost of every order, which will save considerable detail work, but the cost today, tomorrow or a year hence can be obtained if the records are filed indicating the output of each molder per day on the various patterns. In conclusion, it will be noted that the percentage theory has not been used for figuring the overhead, but rather the amount in dollars and cents, in the belief that this can be followed more satisfactorily by the heads of the operating departments without losing the support of the accountant.

In line with the foregoing theory, the profit should be figured in dollars per ton. Let it be assumed that the justified profit is $2 on an average tonnage per month of 100, or a total of $200. If the work going through the shop is slow-moving, notwithstanding the fact that every molder is employed when only 50 tons are produced the profit should be $4 per ton, which equals the average of $200 per month. If, on the other hand, the work going through the shop is of the rapid-moving variety, so that the same number of molders produce twice the output of 200 tons, the profit could be reduced to $1 and yet make the average of $200 per month. The results by this

method of computation are the same regardless of the class of work taken by the sales department.

Imports to Dutch East Indies

The total imports of iron and steel, including nails, to the Dutch East Indies, during 1914 were valued at $12,350,500, made up of miscellaneous iron and steel work valued at $10,200,000; galvanized iron roofing, $1,300,000; and iron nails, $850,000. The imports from the United States are given at $141,650, made up of iron and steel work valued at $118,300 and iron nails at $23,350. Iron and steel wire is not included in these statistics.

The total value of machinery imported into the Dutch East Indies during 1914 is given as $10,556,595, divided as follows: agricultural machinery, $3,823,540; railway machinery, $1,726,870; and miscellaneous machinery, $5,006,185, compared with a total value of $13,383,280 for 1913. The value of American machinery imported during last year is given at $105,200. It is difficult to obtain the correct figures on the value of American machinery imported, as this is an article that is generally bought through the Netherlands and has formerly been shipped via Dutch ports and entered as Dutch goods. About half of the American machinery imported into this colony during 1914 was for agricultural purposes. One of the large engineering concerns in Java sent a representative to the United States in October, 1914, to endeavor to enter into business relations with American machinery manufacturers.

Graphite in Madagascar

The low prices ruling on the world's market for graphite during 1913 and 1914 did not altogether discourage the impetus taken on by the graphite industry in Madagascar during the last four or five years, and notwithstanding the demoralized state of the graphite market shortly after the commencement of the war, the exports of this mineral from the island in 1914 amounted to 7,940 tons, valued at $612,064, compared with 6,573 tons valued at $558,212 in 1913. More than two-thirds, or 5,338 tons, of the quantity exported in 1914 went forward in the first six months of the year. The production for 1912 was 5,000 tons; in 1913, 6,319 tons; and for 1914 the export figures are officially given to represent the quantity produced during that year. It is evident, however, that, on account of the low prices ruling, several lots of graphite were not shipped. For some time previous to the war, graphite material of 92 to 95 carbon, which brought in 1912 as much as 600 to 700 francs ($115 to $135.10), per ton, f. o. b., Tamatave, would not bring locally more than 400 to 425 francs ($77.20 to $82), and after the war broke out there were no buyers, and the various mines were practically shut down. Beginning early in 1915, offers from France were again made for graphite, and in August, 1915, there was a good demand, for the account of French and British concerns, for all classes of material, and the mines are becoming active again. Prices are yet somewhat low, but the lower grades, which were formerly not taken, are now largely purchased. Material of 90 per cent and over brings locally 400 francs ($77.20); that from 85 to 90 per cent, 350 francs ($67.55); 80 to 85 per cent, 300 francs ($57.90), and that from 65 to 80 per cent, 250 francs ($48.25). These are the prices paid by local firms with European headquarters, but it is understood that higher offers are being made direct to the local producers by European concerns, and it is expected that prices will increase.

The Rolling Mill Industry

By F. H. KINDL, Engineer

In this work the author has endeavored to give a condensed, general description of iron and steel rolling mills and their products, without discussing the details of rolling any special material. Essentially, it is a summary of American rolling mill practice, its development being traced from the beginning to the present day.

An effort has been made to define more closely the various mills and their products and the various classifications therein presented have been approved by leading manufacturers and many of the country's foremost iron and steel engineers.

The charts which graphically show the production of semi-finished and finished products, from 2,000 pounds of iron ore, 1,000 pounds of coke and 600 pounds of limestone represent modern practice at some of the largest open-hearth plants and rolling mills. Charts also are included to clearly illustrate the amounts of material charged and produced in making one ton of pig iron; the distribution and production of iron and steel in 1907 and 1911; the conversion of pig iron into the various finished products, etc.

For those interested in the economics of the iron industry, a table has been prepared in which a comparison has been made of the general fundamental factors dictating the production of pig iron in the United States, Germany and Great Britain, with particular reference to the Pittsburgh district of the United States, the Rheinland-Westfalia district of Germany, and the Cleveland district of Great Britain.

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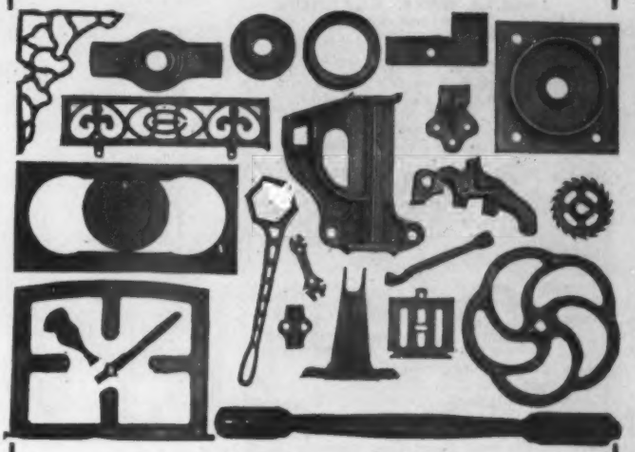

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Watson-Stillman Co., New York City.
Wood, R. D., & Co., Philadelphia, Pa.

ALLOYS.
American Vanadium Co., Pittsburgh, Pa.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, England.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

ALLOY STEELS.
Central Steel Co., The, Massillon, O.

ALUMINO-VANADIUM.
American Vanadium Co., The, Pittsburgh, Pa.

ALUMINUM.
(Vanadium.)
American Vanadium Co., Pittsburgh, Pa.

ANGLE AND EYE BENDERS.
(Hand Machines.)
Hinman, D. A., & Co., Sandwich, Ill.

ANGLES.
(Cold Drawn.)
Interior Metal Mfg. Co., Jamestown, N. Y.

ANGLES, TEES, CHANNELS.
(Iron and Steel.)
American Bridge Co., New York City.
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Eichleay, John, Jr., Co., Pittsburgh, Pa.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Sons, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.

ANNEALING BOXES.
Mesta Machine Co., Pittsburgh, Pa.
Pittsburgh Annealing Box Co., Pittsburgh, Pa.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Pittsburgh Valve Foundry & Const. Co., Pittsburgh, Pa.
Swedish Crucible Steel Co., Detroit, Mich.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Zanesville Malleable Iron Co., Zanesville, O.

ANNEALING POTS.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Zanesville Malleable Iron Co., Zanesville, O.

APPLIANCES.
(Steel Works.)
Blair Engineering Co., Chicago, Ill.

ARMATURES.
Crocker-Wheeler Co., Ampere, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

AXLES.
American Bridge Co., New York City.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Otis Steel Co., Cleveland, O.

BABBITT.
Lubricating Metal Co., The, New York City.

BAKERS.
(Wire Coating, Wire Rivet and Bolt Works.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BALLS.
(Steel.)
New Departure Mfg. Co., Bristol, Conn.

BANDS.
Carnegie Steel Co., Pittsburgh, Pa.

BARGES.
American Bridge Co., New York City.

BARRELS.
(Tumbling, Welded Chain and Wire Nail Mills.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BARROWS.
Sterling Wheelbarrow Co., Milwaukee, Wis.

BARROWS.
(Coal and Coke.)
Sterling Wheelbarrow Co., Milwaukee, Wis.

BARROWS.
(Foundry.)
Sterling Wheelbarrow Co., Milwaukee, Wis.

BARROWS.
(Pig Iron.)
Sterling Wheelbarrow Co., Milwaukee, Wis.

BARS—ALLOY.
(Forged and Rolled.)
Central Steel Co., The, Massillon, O.

BARS.
(Concrete Reinforcing.)
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Franklin Steel Works, Franklin, Pa.
Inland Steel Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
Ryerson, Jos. T., & Son, Chicago, Ill.
Upson Nut Co., Cleveland, O.

BARS.
(Iron and Steel.)
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., Cleveland, O.
Brown-Wales Co., Boston, Mass.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Harvey, Arthur C., Co., Boston, Mass.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
United Steel Co., Canton, O.
Upson Nut Co., Cleveland, O.

BARS.
(Norway and Swedish Iron.)
Bourne-Fuller Co., Cleveland, O.
Brown-Wales Co., Boston, Mass.

BARS.
(Rounds, Flats, Squares, Etc.)
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.
Upson Nut Co., Cleveland, O.

BARS.
(Sheet.)
Andrews Steel Co., Newport, Ky.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Republic Iron & Steel Co., Youngstown, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Youngstown Iron & Steel Co., Youngstown, O.

BARS.
(Sheet and Tin.)
Andrews Steel Co., The, Newport, Ky.

BARS.
(Splice.)
Carnegie Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

BARS.
(Wrought Iron.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., Cleveland, O.

BEAD.
(Corner.)
Youngstown Iron & Steel Co., Youngstown, O.

BEAMS.
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Scully Steel & Iron Co., Chicago, Ill.

BEARINGS.
(Ball.)
New Departure Mfg. Co., Bristol, Conn.

BEARINGS.
(Bronze Mill.)
American Car & Ship Hdw. Mfg. Co., BEARINGS. New Castle, Pa.

BEARINGS.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

BEDS.
(Cooling.)
Morgan Construction Co., Worcester, Mass.

BELT CEMENT.
Graton & Knight Mfg. Co., Worcester, Mass.

BELT DRESSING.
Graton & Knight Mfg. Co., Worcester, Mass.
Texas Company, The, New York City.

BELT LACING.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.

BELTING.
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BELTING.
(Chrome.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.

BELTING.
(Leather.)
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BELTING.
(Round Leather.)
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BELTING.
(Waterproof Leather.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BENCHES.
(Draw, Wire, Rivet and Bolt Works.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., BENCHES. Cuyahoga Falls, O.

BENCHES.
(Steel.)
New Britain Mach. Co., New Britain, Conn.

BENZOL RECOVERY PLANTS.
Koppers, H., Co., Pittsburgh, Pa.

BILLETS.
Andrews Steel Co., The, Newport, Ky.
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sheet & Tube Co., Youngstown, O.

BILLETS.
(Forging.)
Andrews Steel Co., The, Newport, Ky.
Inland Steel Co., Chicago, Ill.

BILLETS.
(Soft, Open Hearth, Forging-Alloy.)
Andrews Steel Co., Newport, Ky.
Central Steel Co., The, Massillon, O.

BLADES.
(Shear.)
White, L. & I. J., Co., Buffalo, N. Y.

BLAST FURNACE BUILDERS.
Brown, P. J., Construction Co., Cleveland, O.

See Index to Advertisements for page containing advertisements of companies listed above

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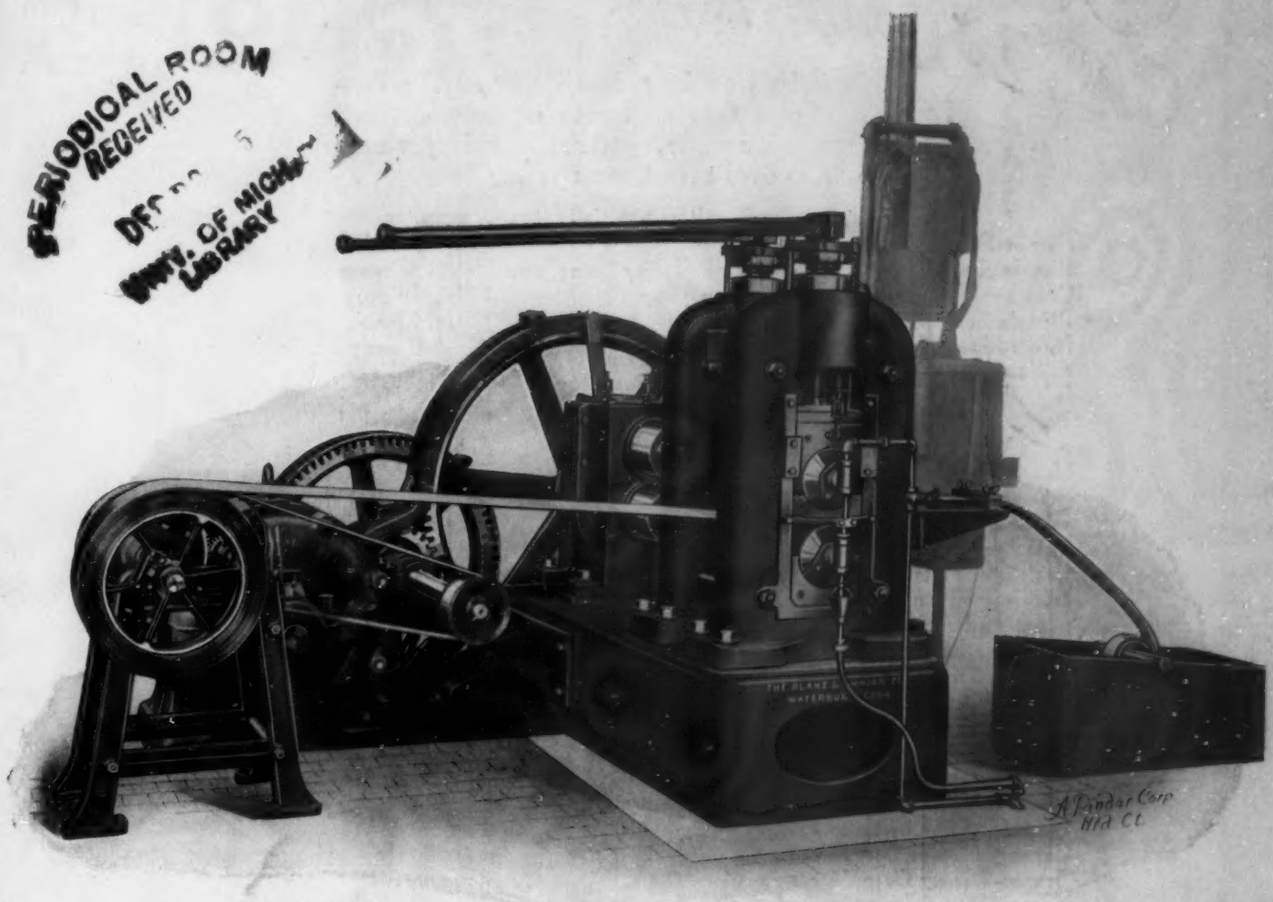

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Waterbury, Conn., U. S. A.

Since 1849

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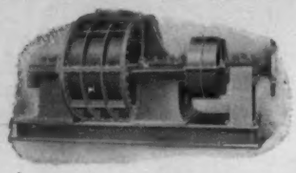

HIGH PRESSURE GAS PUMP

CONNERSVILLE GAS PUMPS AND EXHAUSTERS

Are in Use in a Majority of the By-Product Coke Oven Plants of the United States and Canada, outnumbering more than two to one all other makes.

They Are Employed by the Following Companies

Semet-Solvay Company	Ensley, Alabama
Birmingham-Tuscaloosa Railway & Utility Company,	Holt, Alabama
Coal Products Manufacturing Company	Joliet, Illinois
Illinois Steel Company	Joliet, Illinois
By-Products Coke Corporation	South Chicago, Illinois
Indiana Steel Company	Gary, Indiana
Inland Steel Company	Indiana Harbor, Indiana
Indianapolis Gas Company	Indianapolis, Indiana
Kentucky Solvay Coke Company	Ashland, Kentucky
New England Gas & Coke Co.	Boston, Massachusetts
Semet-Solvay Company	Detroit, Michigan
Laclede Gas Light Company	St. Louis, Missouri
Camden Coke Company	Camden, New Jersey
Lackawanna Steel Company	Buffalo, New York
Dominion Iron & Steel Company, Limited	Sydney, Nova Scotia
Cleveland Furnace Company	Cleveland, Ohio
Republic Iron & Steel Company	Youngstown, Ohio
Algoma Steel Corporation	Sault Ste Marie, Ont., Can.
Semet-Solvay Company	Dunbar, Pennsylvania
Cambria Steel Company	Johnstown, Penn'a.
Lackawanna Iron & Steel Company	Lebanon, Pennsylvania
Pennsylvania Steel Company	Lebanon, Pennsylvania
Chattanooga Gas & Coal Products Company	Chattanooga, Tennessee
Semet-Solvay Company	Benwood, West Virginia
Carnegie Steel Company	Farrell, Pennsylvania
Semet-Solvay Company	Syracuse, New York
Northwestern Iron Company	Mayville, Wisconsin

We Have Orders for Machines from the Following

Youngstown Sheet & Tube Company	Youngstown, Ohio
Toledo Furnace Company	Toledo, Ohio
Lehigh Coke Company	South Bethlehem, Penna.
La Belle Iron Works	Steubenville, Ohio
Citizens Gas Company	Indianapolis, Indiana
Tennessee Coal & Iron Company	Ensley, Alabama
United Steel Company	Canton, Ohio
M. A. Hanna & Company	Canal Dover, Ohio
Michigan Alkali Company	Wyandotte, Michigan
Calhoun Gas Company	Battle Creek, Michigan

The Connersville Blower Company

CHICAGO
929 Monadnock Block

Connersville, Indiana

NEW YORK
114 Liberty Street

Say you saw it in THE IRON TRADE REVIEW

RITER-CONLEY MANUFACTURING CO.

STEEL CONSTRUCTION
PITTSBURGH, PA.

THE RITER WAY: — *A good job conscientiously executed, unrestricted guarantee and the customer's feeling of security.*

The oil man knows or should become acquainted with the R-C oil tanks, stills, etc. One 55,000-barrel oil tank daily does not tax our capacity.

The above is one of our specialties. We design, fabricate and erect plate and structural steel work of every description.
When You Think of Steel Construction. Think of Us.

BLUE CHIP

AND OTHER

FIRTH-STERLING TOOL STEELS

The knowledge, experience and skill of Sheffield combined with the best Pittsburgh practice have made these steels the Standards of Quality and Uniformity wherever Tools are used.

FIRTH-STERLING STEEL COMPANY
McKeesport, Pa.

Boston New York Philadelphia Chicago Detroit Cleveland Pittsburgh San Francisco

JOHN O. PEW, Pres. and Gen. Mgr. **MASON EVANS, Treas.** **H. W. HEEDY, First Vice Pres.** **CHARLES B. CUSHWA, Gen. Supt.** **C. A. COCHRAN, Second Vice-Pres. and Sec.** **G. F. DANIELSON, Mgr. Pressed Steel Dept.**

The Youngstown Iron & Steel Company

YOUNGSTOWN, OHIO

Manufacturers of

Red Steel Plates
Box Annealed Sheets
Blue Annealed Steel
Galvanized Steel Sheets

Bessemer and Open Hearth

Corrugated Steel Sheets---Expanded Metal and Metal Lath

Special Sheets for Deep Drawing

ALL INQUIRIES GIVEN PROMPT ATTENTION

Say you saw it in THE IRON TRADE REVIEW

ILLINOIS ILLINOIS

Illinois Steel Company

GENERAL OFFICES:
208 South La Salle St., Chicago, Ill.

Steel Bars for Concrete Reinforcing

Cold Twisted Squares

NEW BILLET STOCK, Open Hearth Steel, structural grade, with MINIMUM ELASTIC LIMIT of 55,000 lbs. PER SQUARE INCH. Increased physical properties allow use of less tonnage and greater variety of sizes. Only steel manufactured in the most competent and careful manner will stand the rigid physical test of cold twisting. Also the operation of cold twisting removes the adhering scales, thus permitting a better bond with the concrete.

Rounds Plain Squares Flats

NEW BILLET STOCK, either OPEN HEARTH or BESSEMER STEEL, with MINIMUM ELASTIC LIMIT of 33,000 lbs., 40,000 lbs. or 50,000 lbs. per square inch. Furnished in ANY SIZE or LENGTH and in strict accordance with MANUFACTURERS' STANDARD SPECIFICATION. Also will consider SPECIAL ANALYSIS or PHYSICAL PROPERTIES if so desired.

If you have work in hand or prospective work in view, submit details to us and let us figure with you.

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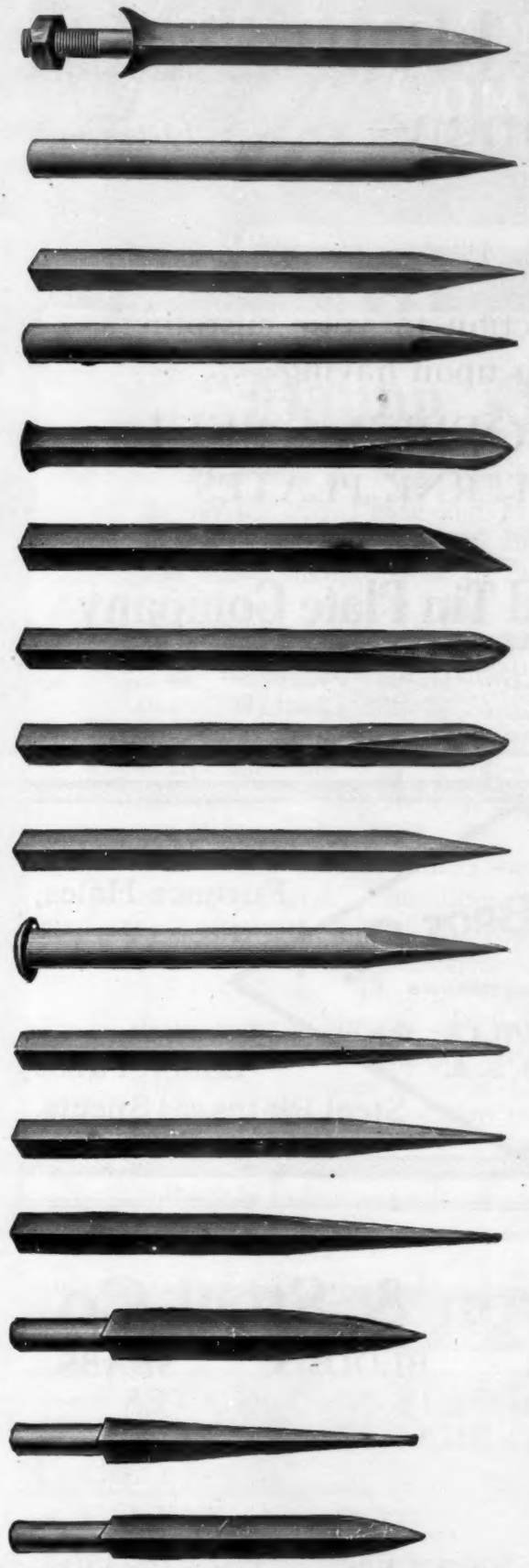
Birmingham: Brown-Marx Building
Boston: John Hancock Building
Buffalo: Marine National Bank Building
Cincinnati: Union Trust Building
Cleveland: Rockefeller Building
Denver: First Nat'l Bank Building
Detroit: Ford Building
New York: Hudson Terminal Building
New Orleans: Maison Blanche
Philadelphia: Widener Building
Pittsburg: Carnegie Building
St. Louis: 3rd Nat'l Bank Building
St. Paul: Pioneer Building

Pacific Coast Representatives: U. S. Steel Products Co., San Francisco, Seattle, Portland, Los Angeles
Export Representatives: U. S. Steel Products Co., New York City

ILLINOIS ILLINOIS



INLAND HARROW TEETH

We are able to offer reasonably prompt delivery of

Rail Carbon Steel Harrow Teeth

But the tendency is toward over-full order-books, delayed deliveries and higher prices.

We do not care to obligate ourselves very far in the future at present prices, but can take care of orders on a basis that will effect important economies to our patrons and insure them against the shortage which seems imminent.

Let us quote on your requirements while we are still able to keep pace with the heavy demand already developing.

INLAND STEEL COMPANY
First National Bank Bldg., Chicago
Works-Indiana Harbor, Ind. and Chicago Heights Ill.
Branch Offices-ST.LOUIS-ST.PAUL-MILWAUKEE-DENVER-DALLAS

Gladden the Hearts of Your Workmen—

KEYSTONE COPPER STEEL

Minimize your worries—

Bring the inspiration of *quality* to your men—

Insure the greatest satisfaction to your customers—
by specifying and insisting upon having

KEYSTONE COPPER STEEL
SHEETS AND TERNE PLATES

A timely message for the New Year—our booklet "Recent Progress in Corrosion Resistance."

American Sheet and Tin Plate Company

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Export Representatives: United States Steel Products Company, New York City

Pacific Coast Representatives: United States Steel Products Co., San Francisco, Los Angeles, Portland, Seattle

Flanged and Dished Boiler Heads.

Saddles, Manholes, Furnace Holes, etc.

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MANUFACTURERS
COATESVILLE, PA.
U. S. A.

Irregular Heads for Marine Work.

Boiler Tubes Steel Plates and Sheets.

Richard G. Wood, President
J. R. Jones, Vice-Pres. and Treas.

Established 1826

W. W. Lukens, Sec. and Asst. Treas.
Howard Wood, Jr., Asst. Sec.

Alan Wood Iron & Steel Co.

PIG IRON BILLETS BLOOMS SLABS
IRON AND STEEL SHEETS AND PLATES
FORGING BILLETS

"A. W. Diamond" and "A. W. Ribbed" Pattern Rolled Steel Floor Plates

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50 Church St.

GENERAL OFFICES:
Widener Building, PHILADELPHIA, PA.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Y STEEL I BRAND PIPE STAR IRON BRAND

THE YOUNGSTOWN SHEET AND TUBE COMPANY NEW PROCESS PATENTED YOUNGSTOWN, OHIO GALVANIZED SHEETS

YOUNGSTOWN, OHIO

"Happy New Year"

What does the New Year hold for us all? We trust that it may be only Peace and Prosperity and Progress for our Country, for our Customers and for our Competitors—share and share alike.

The past year has been generous to us in the matter of Progress. It has seen the realization of dreams long cherished—the fulfillment of prophecies and the practical completion of projects long planned.

During 1915 our already great plant has been expanded in many directions and facilities provided which contribute materially to that perfection in service which has always been our pride.

Service is a much abused word. Too frequently it has only an empty sound. Conditions prevailing during recent months have shown the futility of claims for quality in service that are not backed by extraordinary equipment as well as by ordinary desire to serve. They have shown that Service implies the desire to serve *plus the ability to serve.*

In the next issue of this publication will be told in this space something of the expansion of our works during 1915—expansion that has involved the expenditure of many millions of dollars and has provided for our customers the nearest approach to absolute perfection in service which is humanly possible.

It will be an interesting story for both the steel man and the layman. Watch for it.

DOUBLE REFINED PUDDLED IRON ROOFING

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PITTSBURG, PA. DENVER, COLO.
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ATLANTA, GA.

BUCKEYE FENCE

Specialists in
Alloy Steels

CANTON
Ohio

"UNITED"

Chrome Vanadium Steel

Open Hearth and Electric

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ONE PASS COLD ROLLED

Make your inquiries known to headquarters if you want prompt quotations—and also prompt shipments. Whitaker Brand Black Sheets will help you out of many a big difficulty.

Write us now!

Whitaker-Glessner Co.
Portsmouth Wks.,
Portsmouth, Ohio

THE
ANDREWS
STEEL
CO.
NEWPORT, KY.

Makers of

FORGING AND RE-ROLLING BILLETS

SHEET AND TIN BARS

NICKEL STEEL

ALLOY AND SPECIAL STEELS

SEND US YOUR INQUIRIES AND ORDERS
PROMPT SHIPMENTS GUARANTEED

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Seneca Iron and Steel Company

STEEL SHEETS

Seneca Brand
Stands for Quality

Black, Galvanized, Corrugated and Formed Roofing

Buffalo, N. Y.

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TRADE MARK REGISTERED

For over sixty years we have been building the reputation for quality of that word "La Belle"

For the past twelve years we have concentrated on the manufacture of steel.

On everything but cut standard pipe we own all the sources of our raw materials and control every detail and process of manufacture "From mine to market".

SOME OF OUR PRODUCTS

Pig Iron	Plates for Stamping
Slabs	Standard Pipe
Billets	Line Pipe
Sheet Bars	Drive Pipe
Skelp	Casing
Sheared Plates	Tubing
Grooved Plates	Cut Nails
Universal Plates	Sheets

LA BELLE IRON WORKS

General Offices, Steubenville, O.

Works: Wheeling, W.Va.
Works: Steubenville, O.

Why--- Oh, Why?

Why is there danger in specifying "Standard Gauge" when ordering sheet metal?

Why did the "old time iron sheets" last so long?

Why do ordinary steel and iron sheets of today corrode so quickly?

Why does some sheet metal break in forming?

Why is some sheet metal made in an Open Hearth Furnace and other in a Bessemer Furnace?

Why is sheet metal annealed?

These questions and many others equally perplexing are answered in the "Sheet Metal Primer" a book for the sophisticated as well as for the unsophisticated.

If you have never seen sheet metal made here's a book that is as good as a trip through a rolling mill.

And even if you have been through a rolling mill, this book will throw a light on some of the things you saw but which you could not understand.

Every user of sheet metal can procure a copy *without cost or obligation.*

Simply sign—Tear off—Mail

THE STARK ROLLING MILL CO.
CANTON, OHIO

Send me without cost or obligation a copy of the "Sheet Metal Primer."

Name.....

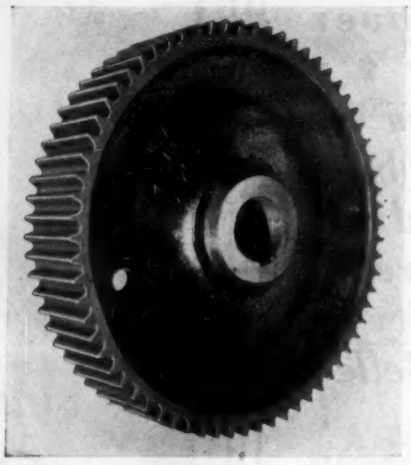
Firm.....

Address.....

L. T.-4

Steel for Service

WORN OUT



NOT BROKEN

Mr. General Superintendent:

You are doubtless aware that in the purchase of machinery the matter of service is of much more importance and significance than the matter of first cost and that the minor portions of your operating equipment are as well worthy of attention and care as your prime movers.

The teeth of the gear shown in the photograph cut from a Carnegie Hard Grade Gear Blank were worn to a thickness of ⅛ inch at the pitch line without signs of fracture or breakage after over a year's continuous service on the bridge drive of a 50-ton hot metal crane.

The crane and load weighed about 100 tons, and **you know** that at a hot metal mixer, owing to prevalence of dirt, graphitic carbon, etc., the service is unusually severe. **You know** also that cast gears would not have given any such service.

This kind of service, however, may be expected when the gears are made from Carnegie Rolled and Forged Gear Blanks.

Why not boost your own business by including in your next order for gears a specification to the effect that they must be cut from Carnegie Rolled and Forged Gear Blanks?

The mark of quality

It protects the user

Carnegie Steel Company

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Birmingham, Boston, Buffalo — DISTRICT SALES OFFICES — Chicago, Cincinnati, Cleveland
Denver, Detroit, New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, St. Paul

Export Representatives: UNITED STATES STEEL PRODUCTS COMPANY, New York City

Pacific Coast Representatives: UNITED STATES STEEL PRODUCTS COMPANY
San Francisco, Los Angeles, Portland, Seattle

Vanadium

GIVES CARBON STEEL
THE PHYSICAL PROPERTIES OF HIGH GRADE
ALLOY STEELS AT MODERATE COST

This is shown by tests of

CARBON-VANADIUM STEEL

a straight carbon steel with only the standard small percentage of vanadium added.

Let us send you copies of these tests.

AMERICAN VANADIUM COMPANY

General Offices . . . Vanadium Bldg., Pittsburgh
General Sales Offices: . . Equitable Bldg., New York
London Office: . . 64 Victoria St., Westminster, S. W.

CAMBRIA

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TWISTED AND DEFORMED

PLATES

UNIVERSAL AND SHEARED

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General Offices, Morris Building, Philadelphia

Works at Johnstown, Pa.

District Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Pittsburgh, Philadelphia, San Francisco, St. Louis, Tacoma

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This book describes, in plain, every-day English, every step in the manufacture of iron and steel, from the ore to the finished product.

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Penton Bldg. CLEVELAND, OHIO

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Service that is Unequaled!

From the World's Largest

BRIGHT FINISHED STEEL PLANT

We offer you anything you may require in *Bessemer, Openhearth, Nickel, Chrome* and *Vanadium Steel*, also *Cold Drawn Elevator Guides*. Guaranteeing you a quality and service that is unrivalled.

Besides the immense stock that is carried at our mill, all of our warehouses carry a large and complete stock in all sizes of

COLD DRAWN SHAFTING and SCREW STOCK
ROUNDS, FLATS, SQUARES and HEXAGONS

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BAR IRON, OLD RAIL BARS AND SHAPES

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Standard, Black and Galvanized
Line Pipe, Drive Pipe, Tubing and Casing

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RAILROAD SPIKES, BOAT SPIKES,
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Republic Iron & Steel Co.

General Offices, Republic Bldg., Youngstown, Ohio

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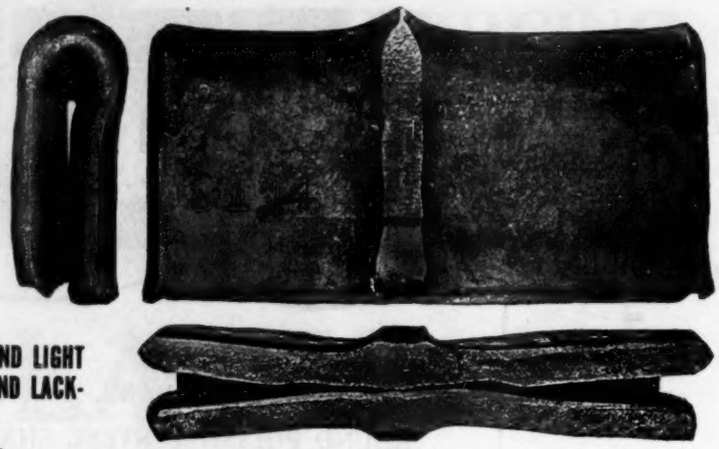
Rough Treatment But No Evidence of Weakness in This Structural Section

This cold bend developed no fracture or other evidence of fibre weakness. We welcome equally severe tests on any of our structural plate and bar steels and gladly quote on specially rolled steel to meet unusual manufacturing requirements.



WE ALSO MAKE STANDARD, HEAVY AND LIGHT RAILS, TRACK BOLTS AND SPIKES, AND LACKAWANNA STEEL SHEET PILING.

Tell us your requirements.

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General Sales Office and Works: Lackawanna, N. Y.

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We ship immediately from Chicago stock

Boiler, Tank and Universal Plates—Beams—Channels—Angles—Tees—Steel and Iron Bars—Norway Iron—Staybolt Iron—Tire Steel—Shafting—Concrete Bars—Hoops—Band Steel—Black and Galvanized Sheets—Blue Annealed and Corrugated Sheets—Keystone Sheets (Weather Resisting)—Steel and Iron Boiler Tubes—Seamless Tubes—Boiler and Structural Rivets—Machine and Carriage Bolts—Lag Screws—Bolt Ends—Boiler-Patch and Staybolts—Nuts—Washers—Hand and Power Machinery—Flanges—Ferrules—Expanders—Valves—Flue Cleaners—Anvils—Vices—Forges Blowers—Turnbuckles—Boiler Lugs, etc.

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Immediate Shipment

From Stocks at

Chicago, St. Louis and St. Paul

BEAMS, Structural
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ANGLES, Structural and Small
TEES, Structural and Small
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COLUMN H-SECTIONS
PLATES, U. M. Sheared and Checkered
ROUNDS, Mild, Forging, Free Cutting, Hammer, Drift Pin, Cold Drawn Screw Stock, Nickel, Chromium Nickel, Polished Shafting and Rivet
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FLATS, Mild, Forging and Cold Drawn Screw Stock
BANDS, Scrolled and Straight Lengths
HEXAGONS, Cold Drawn Screw Stock
SHEETS, Blue Annealed and American Bessemer
SHEET PILING, U. S. Steel
BARK RACK BARS, Double Bevel
RAILS, Heavy and Light
RAIL FITTINGS, Splices, Track Bolts and Spikes
FORGING BILLETS
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Stock List will be mailed regularly to those interested

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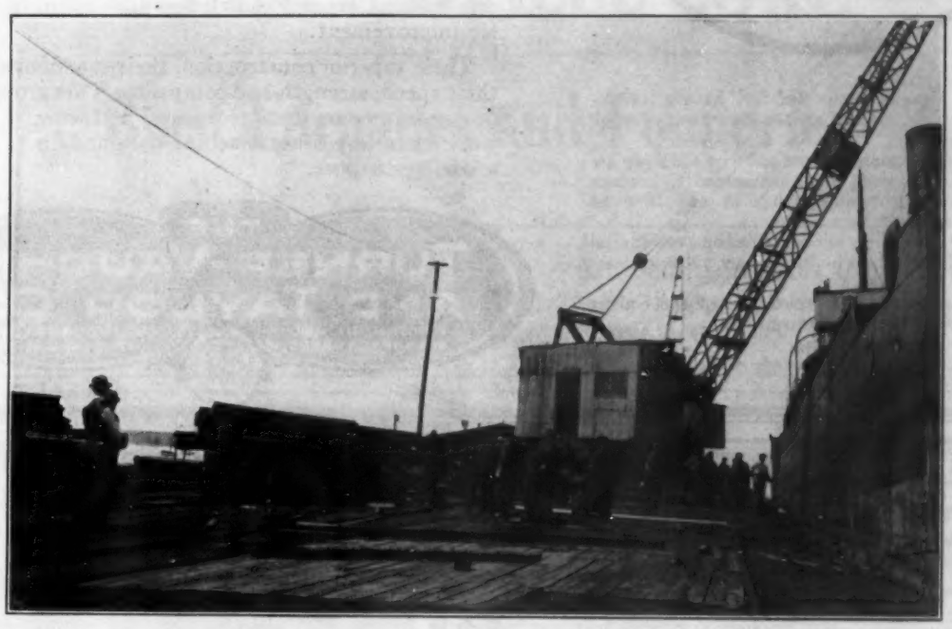
MAKING GOOD STEEL BETTER—No. 17

Nowhere More Necessary Than In Rail Steel



Loading Titanium-Treated Open Hearth Rails for a Great Canadian Railroad System at The Algoma Steel Corporation's Big Steel Plant

The reduced segregation and superior cleanness produced by Titanium Treatment are nowhere more necessary than in heavy duty Rail Steel.

TPC Reg. U. S. Pat. Off. TRADE MARK.

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General Office and Works: Niagara Falls, N. Y.

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TITANIUM

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U. S. Patent No. 1,062,066,
May 20, 1913.
Canadian Patents Pending.

Simplify Working Conditions

Isn't it worth while to *know* that your work is being done *right?*

Isn't it worth while to *know* that every bundle of your scrap wire is *firm* and *regular*—that every chance of having a loose bundle is completely removed?

The

VAUGHN
Scrap Bundlers

are by far the most reliable and efficient scrap machines that have ever been produced. They are the result of 45 years of constant advancement due to our expert knowledge and untiring efforts for improvement.

Their superior construction, their ease of operation, their speed, strength and compactness are grounds for our guaranteeing them to do *more* and *better* work than any other machine designed for a similar purpose.

The Vaughn Scrap Bundlers have a stationary Spindle. The Carriage and Feed Trough are movable.

These machines for wire and wire-rod scrap are made in two sizes, being guaranteed to produce firm, regular bundles, 16 x 18 and 18 x 24 inches in size.

They are entirely self-contained on a substantial base plate, and are built for either motor connection or belt drive.

We also build a *complete line* of the highest grade *Wire Mill Machinery*. You will be greatly interested in the details.

Write today for further information.

THE TURNER-VAUGHN AND TAYLOR CO.
ENGINEERS AND MANUFACTURERS
CUYAHOGA FALLS OHIO. U.S.A.

STEEL SPIKES

FOR

Trolley Lines, Mine Trams and Railroads

It would appear at first thought that "spikes is spikes" but in the case of the spikes made by the Jones & Laughlin Steel Company one must take into consideration our 60 years of experience in the making of iron and steel, our reputation for the highest standards of quality and fair treatment of customers; in short, a J & L railroad spike is something more than just a spike.

All sizes, special points, made according to specifications

SEND FOR SPIKE AND NAIL BOOKLET "W"

Jones & Laughlin Steel Company

American Iron and Steel Works - - - PITTSBURGH

85

J. H. Hillman & Sons Company

OLIVER BUILDING PITTSBURGH, PA.

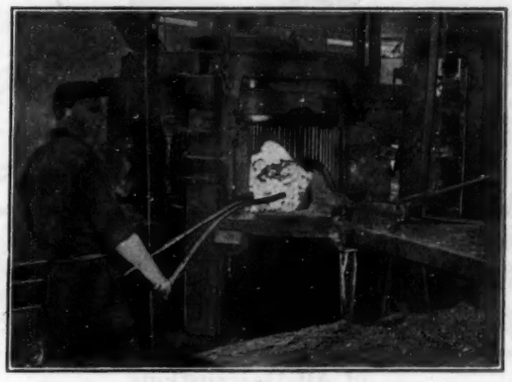
Standard Low Sulphur CONNELLSVILLE COKE

FOR

Blast Furnaces and Foundries

Shipments 3,000,000 Tons Annually. Daily Shipments 10,000 Tons
Any Railroad Delivery.

Where Quality is Considered--Price should be forgotten



SQUEEZER

is an old saying, but it holds as true today as does the *old-fashioned puddling process* of making iron.

The first cost of good iron may be higher than steel, but its final cost is lower; for in the kind of work where quality should be considered, where security is necessary and service is wanted, as in Engine Bolts, Staybolts, Foundation Bolts and similar service, the economy of good iron is indisputable.

Where work is constantly exposed to the weather, to great stress, shock and vibration, the superiority of old fashioned puddled IRON is unquestionable and true economy demands its use---

Not only have the tests of time proved *old fashioned puddled IRON* rust-resisting to a degree unheard of in steel but service tests and special tests like the vibratory test in use by nearly all large railroads, have shown the utter unfitness of steel as compared to it.

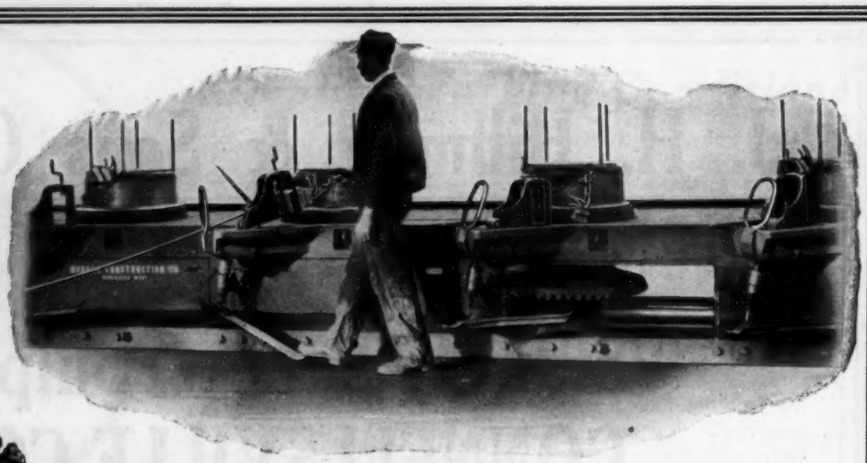
Above is the second phase in the process of converting pig iron into VULCAN FINISHED BAR.

REFINED
VULCAN
VULCAN SPECIAL
VULCAN XX

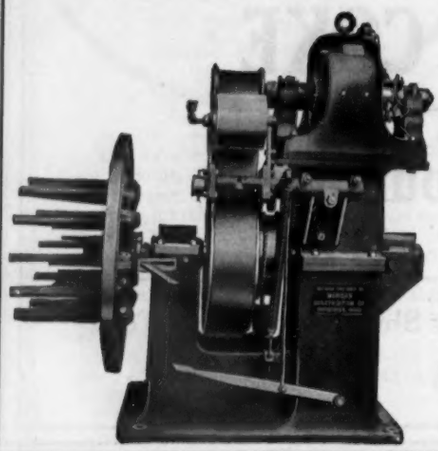
LOCKHART IRON & STEEL CO.
PITTSBURGH, PA.
VULCAN

For Ordinary Uses
For Special Purposes
For Engine Bolts
For Locomotive Bolts

A line of big Money Savers



Rod Frame equipped with Carroll Friction Blocks



MILL EQUIPMENT

The above illustration shows one of our heavy rod frames equipped with ***Friction Blocks.*** Enclosed within each block is a coil clutch. We equip each block with an automatic safety stop.

No draw-out mechanism is required, and the machine is characterized by high efficiency and low maintenance costs.

We also design and build MILLS for ***Billets, Bars, Thin Flats*** and ***Rods.*** Also Heating Furnaces; Cooling Beds; Dyblie Gas and Air Reversing Valves. ***Write us for full details***

MORGAN CONSTRUCTION CO.
WORCESTER, MASS.

Wagon Hardware,
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Rivets,
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Pole Line
Hardware

1915

Picks,
Mattocks
and
Grub Hoes,
Crow Bars,
Wedges, Etc.

1863

MACHINE CARRIAGE BOLTS TRACK BRIDGE

Oliver Iron & Steel Co.
Established 1863
PITTSBURGH, PA.

WASHERS

Wrought and Steel Plate

The Highest Grade, of All Descriptions.

Standard sizes shipped promptly. *Special* sizes on short notice. Also

Annealed Rivet Burrs Felloe Plates. Malleable Washers. Cast Iron Washers

Let us know your requirements. We guarantee Quality and Service.

Wrought Washer Mfg. Co.
Milwaukee, Wis.

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General Office
LEBANON, PENNSYLVANIA
U. S. A.

Rolling Mills and Factories
Located at Reading and Lebanon
Pennsylvania

HOT PRESSED NUTS

ALL SIZES, SHAPES AND STANDARDS
BLANK OR TAPPED

Reg. U. S. Pat. Off.

Reg. U. S. Pat. Off.

Machine Bolts, Track Bolts, Cold Punched Nuts, Rivets, Spikes, Etc.

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BOSTON, MASS.—Oliver Building
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SAN FRANCISCO, CAL.—Monadnock Building

Cable Address—AMBOLT, LEBANON

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ESTABLISHED 1845

Makers of The Celebrated **EMPIRE** BOLTS and NUTS

Western Office: Continental & Commercial Bank Building, Chicago, Ill.

Branch Works: Rock Falls, Ill.

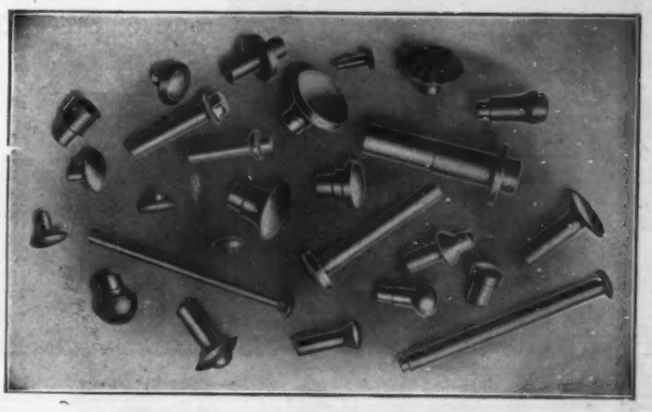
Screws—Rivets—Studs

Sink Bolts, Closet Screws, Complete Line of Machine Screws Boxed for the Hardware Trade. Threaded Wires

Each article illustrated was made for discriminating customers who demand something better than the usual kind. Our process enables us to make many articles that are now made on screw machines. We make them **just as good, much quicker and MUCH cheaper.**

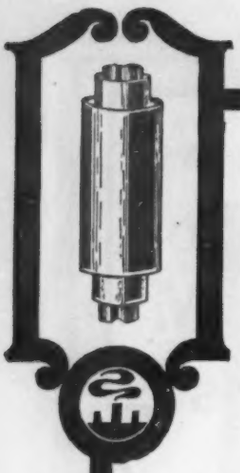
Estimates gladly furnished *State quantity and submit samples*

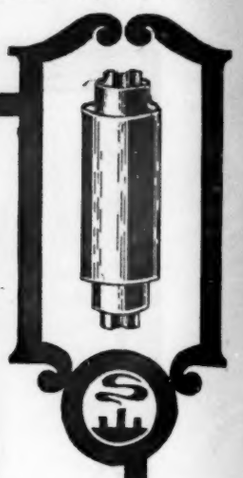
Catalog mailed upon request



The Progressive Mfg. Co.

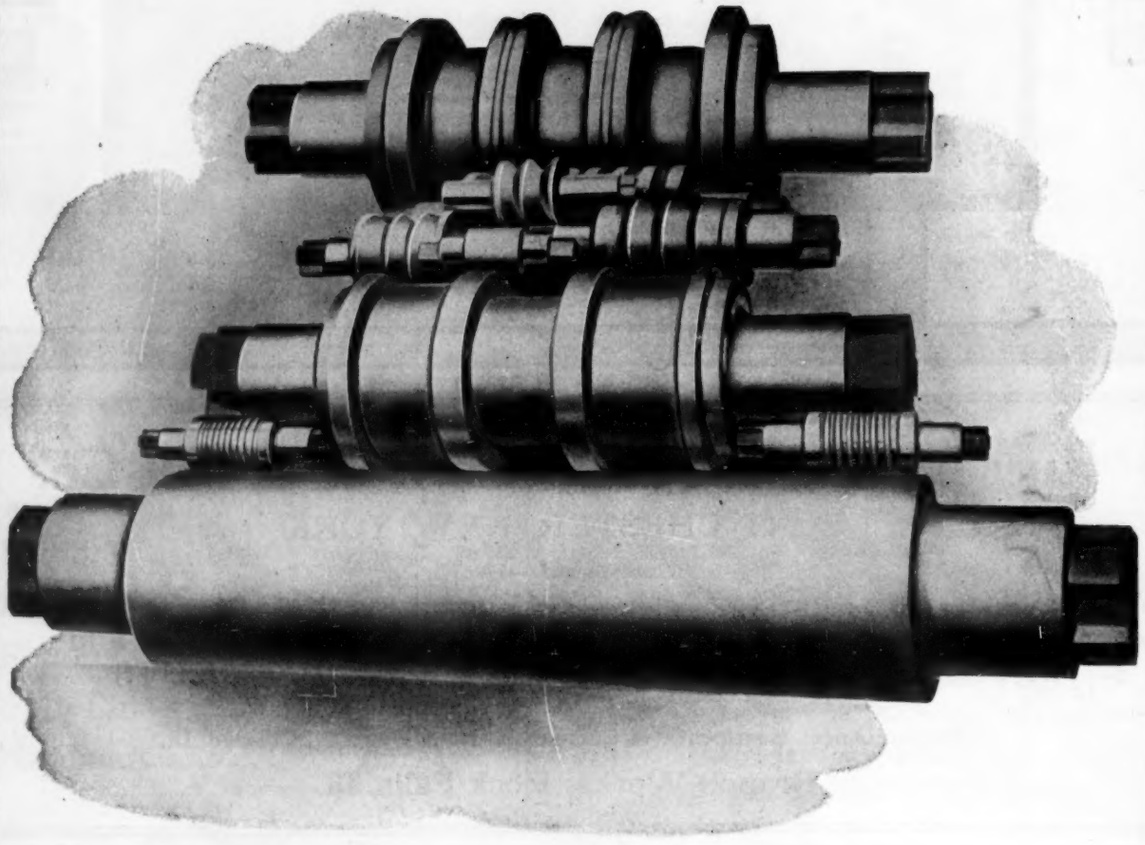
Screw and Rivet Specialists TORRINGTON, CONN.





Superior Rolls

Gears and Pinions



Group of Steel Casting Rolls

MACKINTOSH, HEMPHILL & CO.
FORT PITT FOUNDRY
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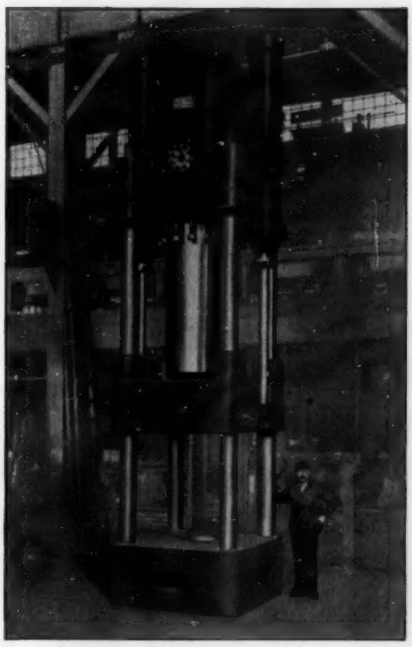
QUICK DELIVERIES
OF
PRESSES AND ACCUMULATORS
ALL TYPES AND SIZES



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HYDRAULIC PRESSES FOR PIERCING, DRAWING, CUPPING, ETC.

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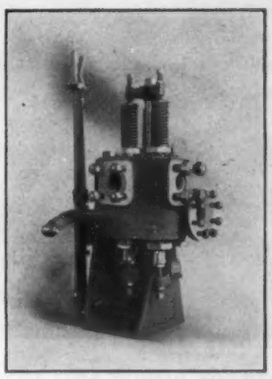

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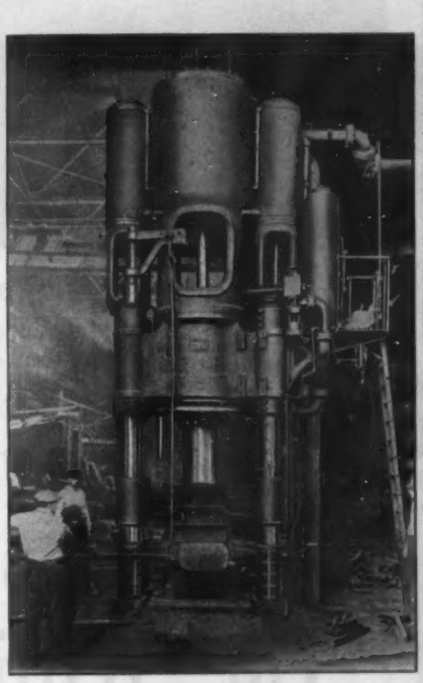

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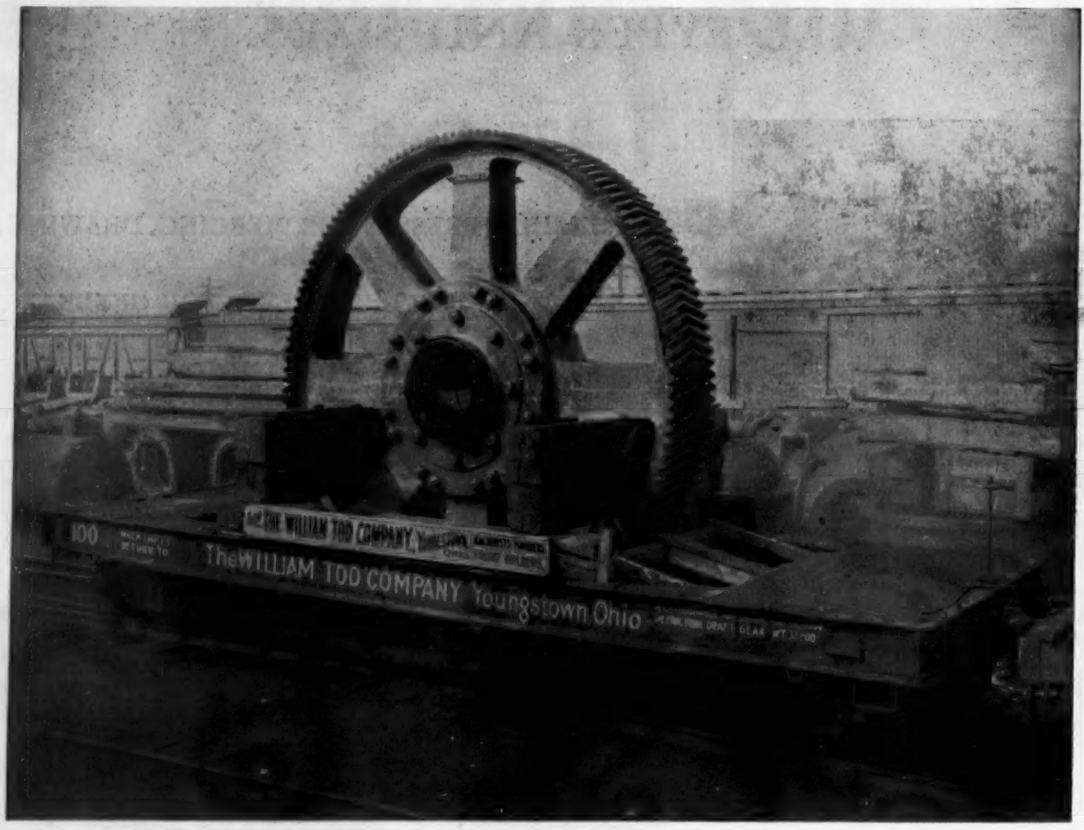
OUR LONG EXPERIENCE AND UNEXCELED FACILITIES ENABLE US TO GIVE YOU EFFICIENT SERVICE IN DESIGNING AND BUILDING THIS CLASS OF MACHINERY.

MESTA MACHINE COMPANY
PITTSBURGH, PA., U. S. A.

DESIGNERS AND BUILDERS

GAS AND STEAM ENGINES, ROLLING MILL MACHINERY, CONDENSERS, STEAM-HYDRAULIC PRESSES, TRANSMISSION MACHINERY, SHEARS, SAWS, ETC.

CUT GEARS



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We solicit your inquiries for gears or for complete drives.

The William Tod Company

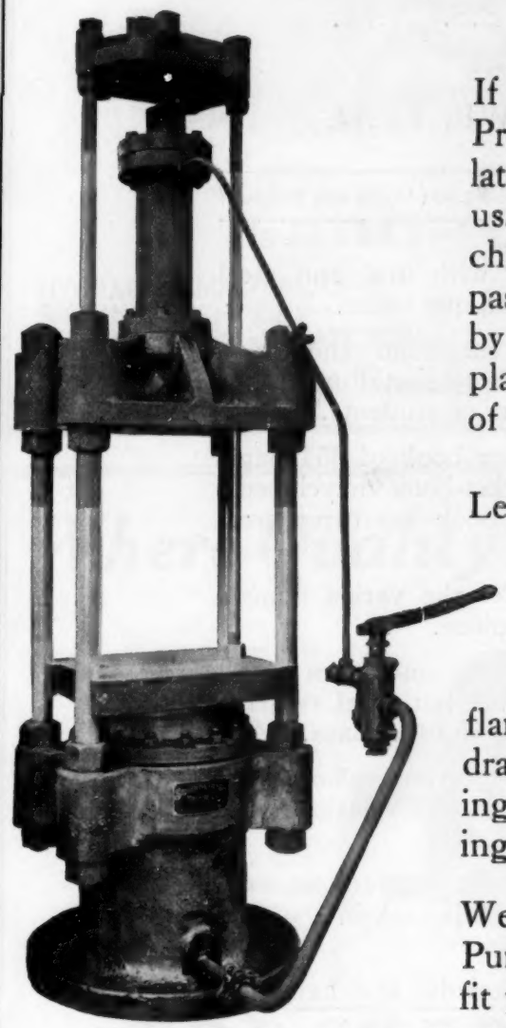
YOUNGSTOWN, OHIO

ROLLING MILLS

ENGINES—Rolling Mill, Gas, Blowing, Pumping.
CONDENSERS, SPECIAL MACHINERY.

SOUTHWARK

Hydraulic Presses, Pumps and Valves



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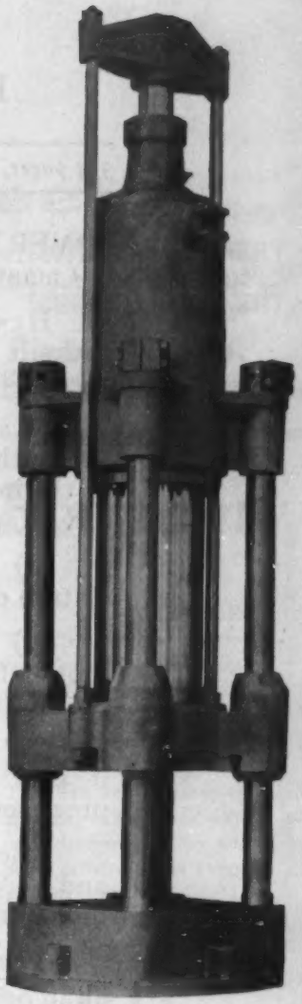
If in need of Hydraulic Presses, Pumps, Accumulators and Valves, consult us. Our Hydraulic Machinery has been favorably passed upon and accepted by the leading machinery plants and steel industries of this country.

Let us send you data and bulletins on Hydraulic equipment for any high pressure purpose, such as forcing, flanging, forging, banding, drawing, piercing, bending, straightening, broaching, etc.

We can supply a Press, Pump or Valve to exactly fit your needs.



500 Ton Piercing Press

Write for Bulletin 8 I. R.

Southwark Foundry & Machine Co.

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IRON AND STEEL

A POCKET ENCYCLOPEDIA INCLUDING ALLIED INDUSTRIES AND SCIENCES

BY

HUGH P. TIEMANN, B.S., A.M.

INTRODUCTION BY

HENRY MARION HOWE, LL.D.

354 pages, leather, pocket size, 4 x 6½, illustrated, $3.00 (12/6) net, postpaid

EVERY man connected in any way with iron and steel manufacture will find this book of unique value.

HENRY M. HOWE writes: "I commend the book without reserve to the whole family of steel metallurgists, be they millmen, metallographists, teachers or students."

In a neat, attractive, flexible leather book of 354 pages the author gives a dictionary and pocket-book encyclopedia of the iron and steel industries. The book has three great advantages:

(1) It brings together and translates the varied nomenclature of the mill, laboratory and the office.

(2) It not only defines the treatment and gives ample cross-references, but it supplies valuable but brief treatises on the subjects given, and much useful reference data.

(3) For those who *use* steel, and for those who *sell* it, it is a valuable guide to the necessary information as to processes and methods.

The author has had a wide experience in practical work and as an author. He has performed his task in a simple, direct and most useful manner.

The book is a dictionary, encyclopedia and handbook all in one.

PENTON'S BOOK NEWS, Cleveland, Ohio

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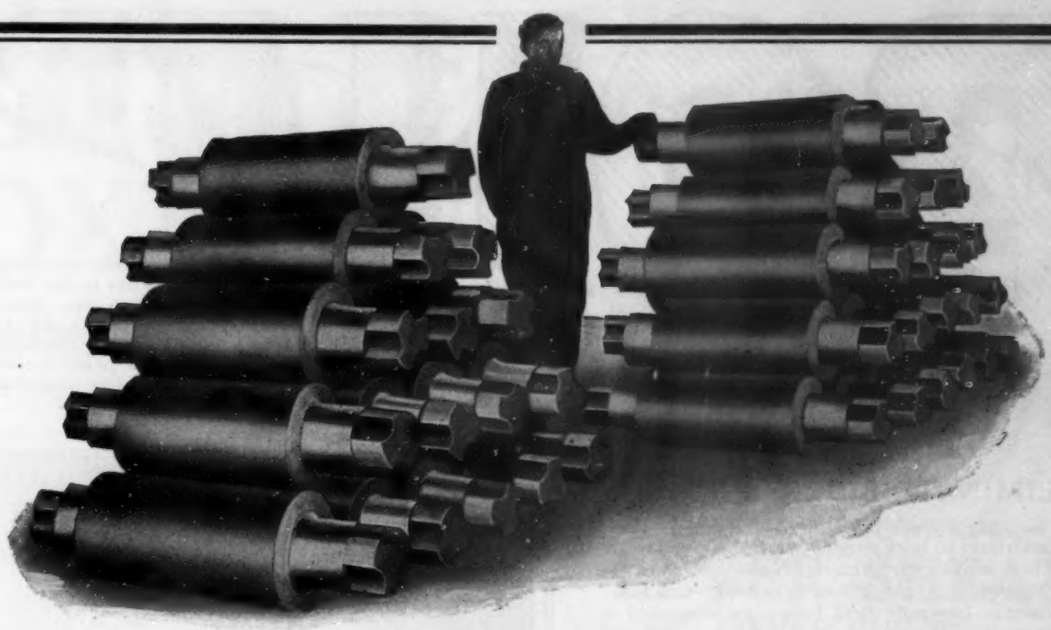

ROLLS
Sand—Chilled—Steel

HYDRAULIC MACHINERY
ROLLING MACHINERY
ROLLING MILL and BLAST FURNACE CASTINGS
CRUSHING and CONCENTRATING MACHINERY
JACKSON BELT LACING MACHINES
SPECIAL MACHINERY

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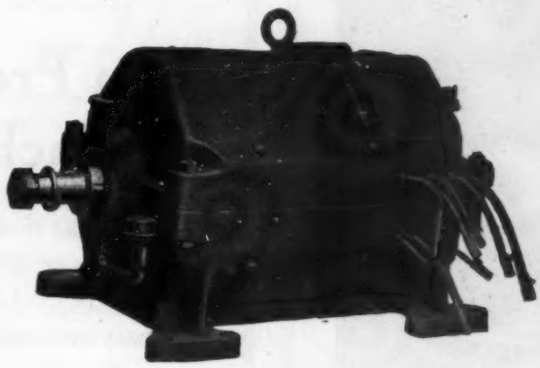
Where Quality proves to be Economy

In the motor, more than in anything else, quality is essential. Not only does the "quality" motor mean a great saving in power, but it also means the elimination of replacements, repairs and shutdowns.

Where the "CROCKER-WHEELER" Motor is in use, upkeep is almost unknown.



CROCKER-WHEELER Form "W" Motors are carefully designed by the most practical engineers. They are made of the best materials. They are built by highly skilled workmen. Therefore, we can guarantee that they will be absolutely dependable—that they will prove satisfactory in every respect.

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Let us refer you to users of CROCKER-WHEELER Mill Motors. We'll be glad to have them tell you their own story.

CROCKER-WHEELER COMPANY
TRADE MARK

Remember, no service is too severe for the "CROCKER-WHEELER" Motor.
Ask for your copy of BULLETIN 1286.

Say you saw it in THE IRON TRADE REVIEW

BOILERS

One of the greatest sources of expense in the upkeep of a boiler is the *brick setting*—but, strange to say, this is seldom taken into account by the purchaser. Besides the continual brick and labor expense in such cases, must be considered the tremendous loss of heat!

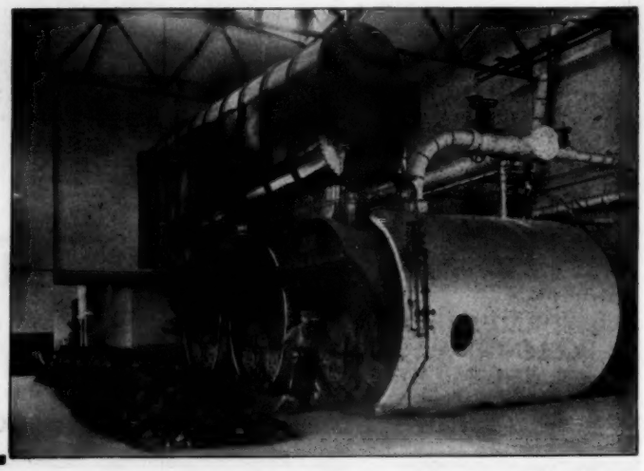
ELIMINATE BRICK SETTINGS

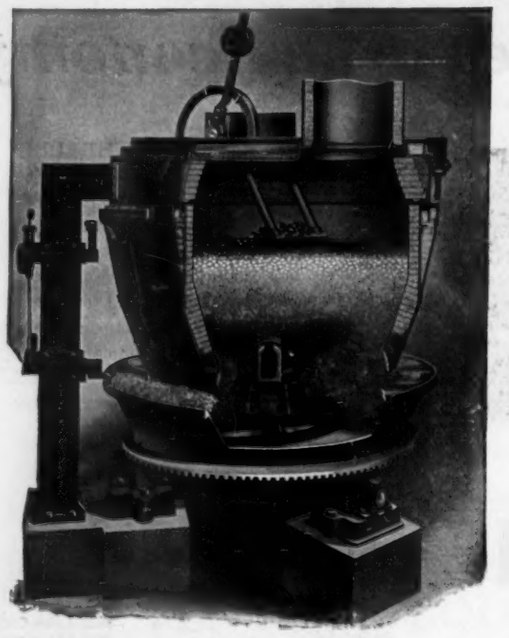
by installing *Freeman Internally Fired Boilers*. These boilers require no brick settings whatever. Consequently lost heat is unknown; brick repairs and brick expenses are unnecessary. Absolute safety is assured.

Freeman Internally Fired Boilers are economical in every way. They occupy much less space and will burn the poorest grades of fuel, saving a large percentage of your fuel costs.

Freeman Internally Fired Boilers have dozens of invaluable superiorities. We are anxious to explain them to you. If you wish better results for less money *WRITE US AT ONCE FOR FULL DETAILS.*

The S. Freeman & Sons Mfg. Co.
RACINE, WIS., U. S. A.





Have you seen those remarkable continuous records made by the

Morgan Producer-Gas Machine?

Nothing like them before. They place this machine in a class entirely beyond the reach of the ordinary mechanical gas producer.

Capacity, Gas Quality, Freedom from Labor and Economy of Installation are all increased to a surprising degree.

See new Catalogue by the

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From Coast to Coast 37 Producing Plants and Distributing Stations provide an unlimited supply of Linde Oxygen for users everywhere.

LINDE SERVICE means no investment except for oxygen actually received — no expensive overhead or upkeep charges.

Linde Oxygen may be obtained from any of the following Linde Plants and Distributing Stations where a large supply of charged 100 and 200 cu. ft. cylinders is kept on hand constantly to insure immediate shipments.

Mail or telephone your order to THE LINDE AIR PRODUCTS CO., at the nearest point. **Shipments will be made on day order is received.**

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Cincinnati, Ohio.	63 Plum Street
Cleveland, Ohio	E. 73rd St. and Bittern Ave.
Columbus, Ohio	310 Dublin Ave.
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Dayton, Ohio	521-523 East First St.
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Pittsburgh, Pa.	25th Street and Allegheny R. R.
Portland, Oregon	104 North Fifth Street
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Seattle, Wash.	530 First Ave., South
St. Louis, Mo.	4218 Forest Park Boulevard
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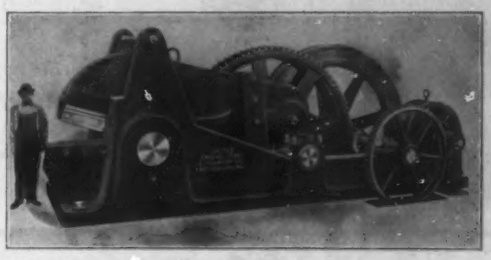
Our Plants and Distributing Stations are planned for other industrial centers throughout the country and will be established as fast as and wherever the local demand for oxygen warrants.

The Linde Air Products Co.
Forty-Second St. Building New York
Largest Producers of Oxygen in America

THE GIANT OF ITS KIND



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LEVER SHEAR
EVER BUILT

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Knives 36" long, with 4 cutting edges.
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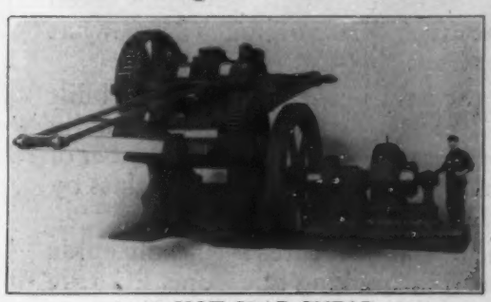
Motor, Engine or Belt Drive.



6 x 30 HOT SLAB SHEAR

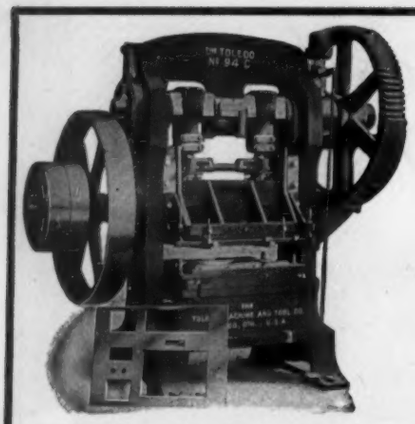
We also build POWER SHEARS and Steam-Hydraulic Shears for all purposes.

WRITE FOR BULLETIN V

UNITED ENGINEERING & FOUNDRY CO.
PITTSBURGH PENNA.

Builders of Complete Machinery Equipment for Iron, Steel and Tube Works; Steel Castings; Machine Molded Gears; Forging Presses, Steel, Sand, Chilled and "Adamite" Rolls.

"LARGEST ROLL MAKERS IN THE WORLD, MAKERS OF THE LARGEST ROLLS"



A "Toledo" Press

that Solves the Profit Problem for Stove Manufacturers

Fitted with this set of dies and automatic stripper attached to slide, it will cut a complete stove front at each stroke.

It is also widely used for cutting, drawing, forming, embossing and perforating on a wide range of sheet metal work.

"Toledo" Presses Solve Every Sheet Metal Problem.

The Toledo Machine & Tool Co.
Toledo, Ohio

Sterling Snap Flasks

When it came to making a snap flask, we simply had to make it as much better than ordinary snap flasks as our steel flasks were better than ordinary wood or cast flasks.

Had to be consistent, you know, even at the risk of involving a somewhat higher cost.

So the Sterling Snap Flask was built from selected cherry wood, heavily armored, and provided with a number of special features that put it in a class by itself.

One of these features is the long guide to the pin, making the cope lift true without tilting.

Another, is the arrangement of the locking hooks which hook upward instead of downward, this sensible construction preventing them from

falling back in place before the flask can be opened.

These are only typical of a number of appreciated features of this flask.

It is fully described and illustrated in our Catalog, No. 24

Sterling Wheelbarrow Co.
64th Ave., West Allis, Wisconsin
Makers of FOUNDRY AND MACHINE SHOP WHEELBARROWS, CARTS, TRUCKS, FLASKS, SKIM GATES, Etc.

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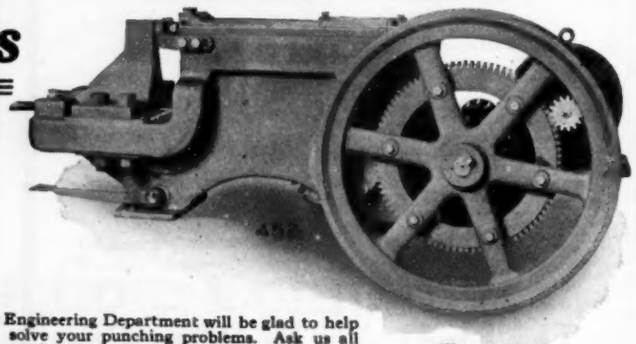
Accurate, Durable, Economical

We build a complete line of high grade punches and shears and our catalog illustrates and describes them in detail. Send for a copy. Cleveland means quality and economy.

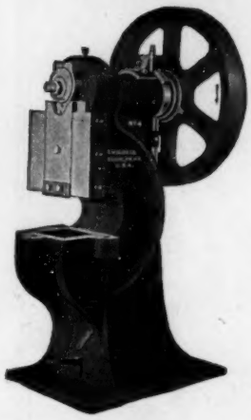


Our Engineering Department will be glad to help you solve your punching problems. Ask us all the questions you wish. Begin *now*.

The Cleveland Punch & Shear Works Co., Cleveland, O.

Entire Pressure is through Solid Metal

BLISS



The graduated eccentric adjustment facilitates setting dies. The slides are long and well gibbed.

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The flywheel can be turned backward to release a punch when stuck in the die.

"Stiles" Punching Presses

are built in ten sizes and adapted for punching, stamping, forming and bending operations, in the economical manufacture of cutlery, hardware, locks, auto parts, sewing machines, typewriters, etc. *Write us at once.*

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PUBLISHED APRIL, 1914

STEEL FOUNDRY

By JOHN HOWE HALL

Consulting Engineer

271 pages, 6 x 9. Illustrated. $3.00, postpaid

THE author covers fully the *metallurgy and production of all classes of ordinary steel castings* in use in this country.

He aims to give:

(1) The characteristics of steel castings from a manufacturing point of view.

(2) The details of the various steel manufacturing processes and their characteristics as applied to the different types of castings, including relative cost of installation, relative cost and quality of steel produced, etc.

(3) Foundry procedure, such as moulding, pouring, annealing, etc.

The book will appeal alike to the metallurgist and the superintendent in charge of the foundry. It covers metallurgical processes, shop methods and costs of steel.

PENTON'S BOOK NEWS
PENTON BUILDING, ∴ CLEVELAND, OHIO

36

Wood Tank Equipment

The man who buys an *inferior* tank today, finds on the morrow that he must buy again. WHY NOT BUY THE *RIGHT* TANK THE FIRST TIME!

In order to get the service to which you are entitled from a tank, the tank must be made of the *right* material and be of the *right* construction.

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"Service-giving material has been the backbone of our organization for forty-seven years."

The quality of our work is unexcelled.

Study the illustration above:

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Let us do it.

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The Pittsburgh and Conneaut Dock Company

R.R RICHARDSON,
GENERAL SUPERINTENDENT.
CLARENCE WALKER,
SUPERINTENDENT.

Conneaut, Ohio.

November 23rd., 1915.

RRR-CC

My Dear Sir:--

Answering your letter Nov. 22nd., with reference to our advertisement which appeared in the last issues of the Iron Trade Review and the Marine Review, beg to advise that we have had such good results from those advertisements, that we find it will be unnecessary to have the advertisement appear in any of your later issues.

Yours very truly,

THE PITTSBURGH & CONNEAUT DOCK COMPANY,

R. R. Richardson
General Superintendent.

To:

IRON TRADE REVIEW,
J. D. Pease, Advertising Manager,
CLEVELAND, OHIO.

CLEVELAND, OHIO, DECEMBER 30, 1915

THE IRON TRADE REVIEW

A weekly publication devoted to the Iron, Steel, Machinery and Foundry Industries of the United States and Canada.

Published Every Thursday by THE PENTON PUBLISHING CO., Cleveland.

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Although mining and smelting operations have thus far made comparatively small progress on the Pacific coast, the possibilities as revealed by numerous surveys appear excellent for the development of the industry. Large surface deposits of ore exist in California, while Alaska, Washington and southern Utah possess suitable coking coals, the latter being the most available. Climatic conditions are also favorable.

RECOMMENDS UNIFORM COST SYSTEM..... 1277

An admirable system designed to simplify methods of accounting foundry costs, has been evolved by a committee of the American Foundrymen's Association. It is based on the facts that the commodity sold by a foundry is labor and not material; the latter varying with market conditions; that the cost of production varies as the output of the individual molder; and that the overhead costs vary in a similar manner.

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The European war, in causing the United States to examine its domestic resources, furnished many surprises. Among these was the realization that with some of the world's largest tungsten ore deposits, foreign nations supplied many of our products. The new industry, launched as a result, relieved a serious situation; but will this business outlast the war? Mr. McKenna here furnishes the answer.

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That is what every honest manufacturer is doing just now.

Mighty few are taking "bonuses" and letting good old faithful customers "whistle".

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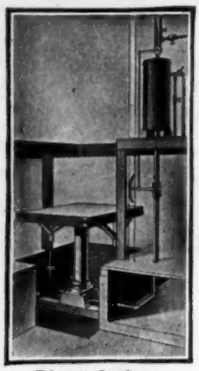
ABSOLUTE PERFECTION IN ELEVATORS.

The big fellows everywhere now'days

"HOOK 'ER TO THE BILER"



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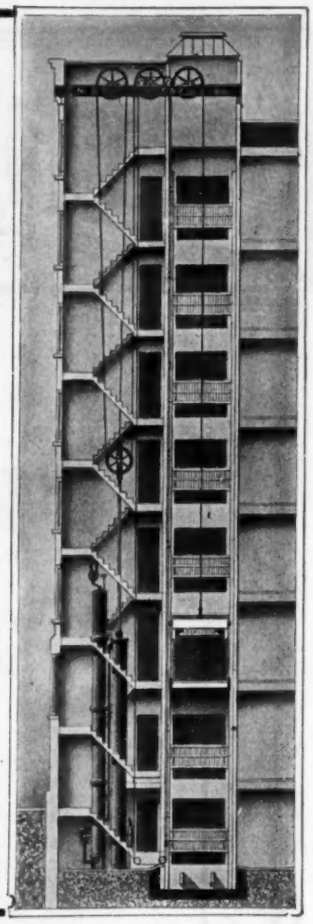

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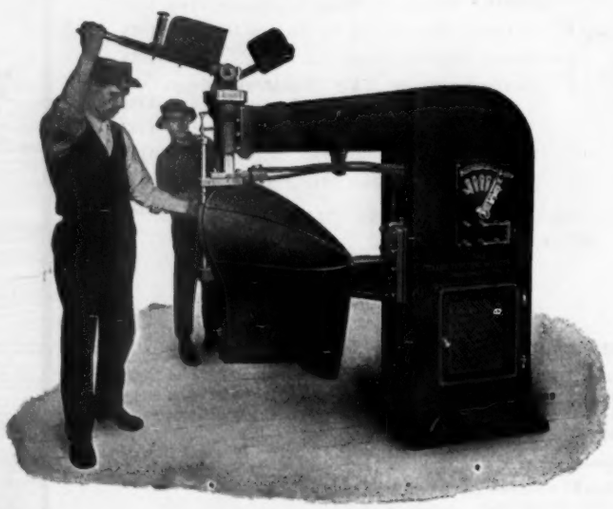

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We will prove this by shipping you a "TOLEDO" on 30 days' trial.

Write for our new Bulletins Nos. 14 and 15. They tell all about "TOLEDO" Butt Welders and Spot Welders.

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(Crucible Steel.)
Adrian Steel Casting Co., Adrian, Mich.
Millbury Steel Fdy. Co., Millbury, Mass.
Sivyer Steel Casting Co., Milwaukee, Wis.
West Steel Casting Co., Cleveland, O.

CASTINGS.
(Die.)
Atlas Steel Casting Co., Buffalo, N. Y.
Lubricating Metal Co., The, New York City.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS.
(Finishing.)
Reed Fdy. & Mach. Co., Kalamazoo, Mich.

CASTINGS.
(Gear.)
Mesta Machine Co., Pittsburgh, Pa.
Strong Steel Foundry Co., Buffalo, N. Y.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.

CASTINGS.
(Gray Iron.)
American Bridge Co., New York, N. Y.
Arcade Mfg. Co., Freeport, Ill.
Barnum-Richardson Co., Lime Rock, Conn.
Bellefonte Engineering Co., Bellefonte, Pa.
Birdsboro Steel Fdy. & Mach. Co., Birdsboro, Pa.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Cyclops Foundry Co., Pittsburgh, Pa.
Dake Engine Co., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farrell Fdy. & Machine Co., Ansonia, Conn.
Flagg, Stanley G., & Co., Philadelphia, Pa.
Klotz Machine Co., Sandusky, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Nordberg Mfg. Co., Milwaukee, Wis.
North Buffalo Hdw. Fdy. Co., Buffalo, N. Y.
Phoenix Iron Works Co., Meadville, Pa.
Quigley Furnace & Foundry Co., New York, N. Y.
Scranton Pump Co., Scranton, Pa.
St. Louis Malleable Casting Co., St. Louis, Mo.
Standard Foundry Co., Buffalo, N. Y.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh Pa.
U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

CASTINGS.
(Gray Iron, Car and Locomotive.)
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.
Quigley Furnace & Foundry Co., New York, N. Y.
United Engrg. & Fdv. Co., Pittsburgh, Pa.

CASTINGS.
(Gray Iron Machinery.)
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.
Klotz Machine Co., Sandusky, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.

CASTINGS.
(Malleable.)
Acme Steel & Mall. Iron Works, Buffalo, N. Y.
Belle City Malleable Iron Co., Racine, Wis.
Columbus Malleable Iron Co., Columbus, O.
Danville Malleable Iron Co., Danville, Ill.
Erie Malleable Iron Co., Erie, Pa.
Flagg, Stanley G., & Co., Philadelphia, Pa.
General Malleable Co., The, Warren, O.
Illinois Malleable Iron Co., Chicago, Ill.
Lakeside Malleable Castings Co., Racine, Wis.
Marion Malleable Iron Works, Marion, Ind.
Missouri Malleable Iron Co., East St. Louis, Ill.
Moline Malleable Iron Co., St. Charles, Ill.
National Malleable Castings Co., Cleveland, O.
Northwestern Mall. Iron Co., Milwaukee, Wis.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Pittsburgh Valve Foundry & Const. Co., Pittsburgh, Pa.
Ross-Meehan Foundry Co., Chattanooga, Tenn.
St. Louis Malleable Casting Co., St. Louis, Mo.
Standard Malleable Iron Co., Muskegon, Mich.
Wisconsin Malleable Iron Co., Milwaukee, Wis.
Zanesville Malleable Iron Co., Zanesville, O.

CASTINGS.
(Malleable Agricultural.)
Danville Malleable Iron Co., Danville, Ill.

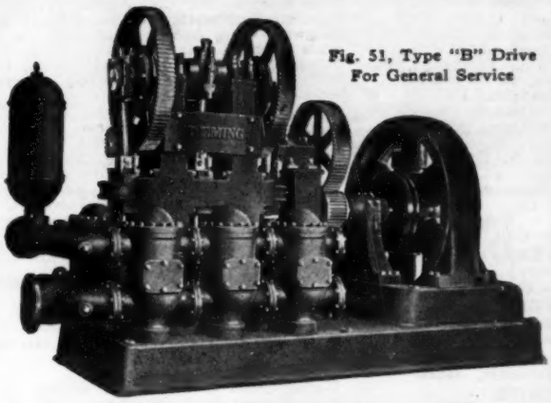
CASTINGS.
(Malleable, Car and Locomotive.)
Lakeside Malleable Castings Co., Racine, Wis.
Marion Malleable Iron Works, Marion, Ind.
Missouri Malleable Iron Co., East St. Louis, Ill.
National Malleable Castings Co., Cleveland, O.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Pittsburgh Valve Foundry & Const. Co., Pittsburgh, Pa.
Zanesville Malleable Iron Co., Zanesville, O.

CASTINGS.
(Manganese Steel.)
Strong Steel Foundry Co., Buffalo, N. Y.
Taylor-Wharton Iron & Steel Co., Highbridge, N. J.

CASTINGS.
(Open-Hearth Steel.)
American Steel Foundries, Chicago, Ill.
Atlas Steel Castings Co., Buffalo, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
National Foundry Co., The, Erie, Pa.
Sharon Fdy. Co., Sharon, Pa.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS.
(Semi-Steel.)
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

See Index to Advertisements for pages containing advertisements of companies listed above



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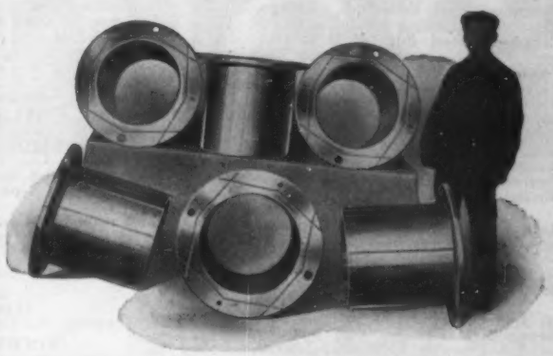
Ralph B. Carter Co., 152 Chambers St., New York City
Root, Neal & Co., 178-180 Main St., Buffalo, N. Y.



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Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Dayton Steel Foundry Co., Dayton, O.
Farrel-Cheek Steel Foundry Co., Sandusky, O.
Federal Steel Foundry Co., Chester, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Millbury Steel Fdy. Co., Millbury, Mass.
National Foundry Co., Erie, Pa.
National Malleable Castings Co., Cleveland, O.
Otis Steel Co., Cleveland, O.
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.
Reed Fdy. & Mach. Co., Kalamazoo, Mich.
Ross-Meehan Fdy. Co., Chattanooga, Tenn.
Sharon Foundry Co., Sharon, Pa.
Sivyer Steel Casting Co., Milwaukee, Wis.
Smith, Geo. H., Steel Casting Co., Milwaukee, Wis.
St. Louis Steel Foundry, St. Louis, Mo.
Strong Steel Foundry Co., Buffalo, N. Y.
Swedish Crucible Steel Co., Detroit, Mich.
United Engineering & Fdy. Co., Pittsburgh, Pa.
West Steel Casting Co., Cleveland, O.
Wheeling Mold & Foundry Co., Pittsburgh, Pa.

CASTINGS.
(Steel, Car and Locomotive.)
American Steel Foundries, Chicago, Ill.
Atlas Steel Casting Co., Buffalo, N. Y.
National Foundry Co., Erie, Pa.
Otis Steel Co., Cleveland, O.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS.
(Steel Converter.)
Sivyer Steel Castings Co., Milwaukee, Wis.
West Steel Castings Co., Cleveland, O.

CASTINGS.
(Steel Electric.)
Dayton Steel Foundry Co., Dayton, O.
National Malleable Castings Co., Cleveland, O.
Smith, Geo. H. Steel Casting Co., Milwaukee, Wis.
Strong Steel Foundry Co., Buffalo, N. Y.
West Steel Casting Co., Cleveland, O.

CASTINGS.
(Steel Machinery.)
American Steel Foundries, Chicago, Ill.
Farrel-Cheek Steel Foundry Co., Sandusky, O.
Mesta Machine Co., Pittsburgh, Pa.
National Foundry Co., The, Erie, Pa.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS.
(Steel Vanadium.)
American Vanadium Co., The, Pittsburgh, Pa.

CASTINGS.
(Vanadium.)
American Vanadium Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Strong Steel Foundry Co., Buffalo, N. Y.

CHAINS.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Weimer Chain & Iron Co., Lebanon, Pa.

CHANNELS.
(Cold Drawn.)
Interior Metal Mfg. Co., Jamestown, N. Y.

CHAPLETS.
Champion Mch. & Forging Co., Cleveland, O.

CHARCOAL.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.

CHEMICALS.
General Chemical Co., Cleveland, O.

CHEMISTS AND METALLURGISTS.
Howard Testing Laboratories, Lockport, N. Y.
Hunt, Robert W., & Co., Chicago, Ill.
Steel Improvement Co., Cleveland, O.

CHIMNEYS.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

CHUCKS.
(Quick Change.)
Modern Tool Co., Erie, Pa.

CLAMPS.
National Tube Co., Pittsburgh, Pa.

CLAY.
(Fire Ground.)
Union Mining Co., Mt. Savage, Md.

CLEVISES.
American Bridge Co., New York, N. Y.

CLUTCHES.
Lehigh Clutch Co., Camden, N. J.

COAL.
Baird & West, Detroit, Mich.
Columbus Iron & Steel Co., Columbus, O.
Eaton, Rhodes & Co., Cincinnati, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
Pickands, Brown & Co., Chicago, Ill.
Rogers, Brown & Co., Chicago, Ill.
Semet-Solvay Co., Syracuse, N. Y.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Washington Coal & Coke Co., Dawson, Pa.

COAL CRUSHERS.
Orton & Steinbrenner Co., Chicago, Ill.

COAL TIPPLES.
American Bridge Co., New York, N. Y.
Eichleay, John Jr., Co., Pittsburgh, Pa.

COCKS, PLUG.
(Acid-Proof.)
National Tube Co., Pittsburgh, Pa.

COILS.
(Pipe.)
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip Co., Pittsburgh.

COKE.
Baird & West, Detroit, Mich.
Bourne-Fuller Co., Cleveland, O.
Eaton, Rhodes & Co., Cincinnati, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
McKeefrey & Co., Leetonia, O.
Mohr, J. J., & Son, Philadelphia, Pa.
Pickands, Brown & Co., Chicago, Ill.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.
Semet-Solvay Co., Syracuse, N. Y.
Snyder & Co., W. P., Pittsburgh, Pa.
Stewart Iron Co., Ltd., Cleveland, O.
Tenn. Coal Iron & R. R. Co., Birmingham, Ala.
Washington Coal & Coke Co., Dawson, Pa.

COKE OVENS.
(By-Products.)
Koppers, H., Co., Pittsburgh, Pa.

COKE OVENS.
(Cross Regenerative.)
Koppers, H., Co., Pittsburgh, Pa.

COMMERCIAL GRINDING.
Norton Grinding Co., Worcester, Mass.

COMPRESSORS.
Southwark Foundry & Machine Co., Philadelphia, Pa.

COMPRESSORS.
(Air.)
General Electric Co., Schenectady, N. Y.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Norwalk Iron Works Co., So. Norwalk, Conn.

COMPRESSORS.
(Gas.)
Norwalk Iron Works Co., So. Norwalk, Conn.

CONDENSERS.
(Barometric.)
Mesta Machine Co., Pittsburgh, Pa.

CONDENSERS.
(Steam, Jet and Surface.)
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Connersville Blower Co., The, Connersville, Ind.
Cooper, C. & G., Co., Mt. Vernon, O.
Southwark Foundry & Machine Co., Philadelphia, Pa.

CONSTRUCTION.
(Concrete.)
Kratzer, W. N., & Co., Pittsburgh, Pa.

CONSTRUCTION.
(Steel and Iron.)
Alliance Structural Co., Alliance, O.
Eichleay, John Jr., Co., Pittsburgh, Pa.
Freeman, S., & Sons Mfg. Co., The, Racine, Wis.
Kratzer, W. N., & Co., Pittsburgh, Pa.
Muskegon Boiler Works, Muskegon, Mich.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

CONSTRUCTION.
(Steel Plate.)
Knox Pressed & Welded Steel Co., Pittsburgh, Pa.

CONTRACT WORK.
Farrell-Cheek Steel Foundry Co., Sandusky, O.
Hill Pump Valve Co., Chicago, Ill.
Klotz Machine Co., Sandusky, O.
Lansing Stamping & Tool Co., Lansing, Mich.
Reed Foundry & Mach. Co., Kalamazoo, Mich.
Scranton Pump Co., The, Scranton, Pa.

CONTRACTORS.
(Piping.)
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.

CONTROLLERS.
(Electric.)
Crocker-Wheeler Co., Ampere, N. J.
Toledo Bridge & Crane Co., Toledo, O.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CONTROLLERS.
(Manual, Automatic, Machine Tool, Crane.)
Electric Controller & Mfg. Co., Cleveland, O.

CONVERTERS.
(Steel Casting.)
Tropenas Converter Co., New York City.
Whiting Foundry Equipment Co., Harvey, Ill.

CONVEYORS.
McMyler Interstate Co., Cleveland, O.

COOLERS AND DRYERS.
Freeman, S., & Sons Mfg. Co., The, Racine, Wis.

COUPLINGS.
American Vanadium Co., The, Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.

COUPLINGS.
(Flexible.)
Connersville Blower Co., The, Connersville, Ind.

COVERING.
(Cold Pipe.)
Armstrong Cork Co., Pittsburgh, Pa.

COVERING.
(Steam Pipe.)
Armstrong Cork Co., Pittsburgh, Pa.

CRANES.
(Charging.)
Alliance Machine Co., Alliance, O.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.

CRANES.
(Electric Traveling.)
Alliance Machine Co., Alliance, O.
Brown Hoisting Machinery Co., Cleveland, O.
Browning Co., The, Cleveland, O.
Euclid Crane & Hoist Co., Euclid, O.
McMyler Interstate Co., Cleveland, O.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Ridgway, Craig & Son, Coatesville, Pa.
Shaw Electric Crane Co., New York, N. Y.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Gantry.)
Alliance Machine Co., Alliance, O.
Brown Hoisting Machinery Co., Cleveland, O.
Industrial Works, Bay City, Mich.
McMyler Interstate Co., Cleveland, O.
Niles-Bement-Pond Co., New York, N. Y.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Grab Bucket.)
Alliance Machine Co., Alliance, O.
Brown Hoisting Machinery Co., Cleveland, O.
Industrial Works, Bay City, Mich.
Niles-Bement-Pond Co., New York, N. Y.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Hand Traveling.)
Euclid Crane & Hoist Co., Euclid, O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Hand Trolley.)
Brown Hoisting Machinery Co., Cleveland, O.

CRANES.
(Hydraulic.)
Alliance Machine Co., Alliance, O.
Chambersburg Engrg. Co., Chambersburg, Pa.
Morgan Engineering Co., Alliance, O.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

CRANES.
(Ingot Stripper.)
Alliance Machine Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.

CRANES.
(Jib.)
Alliance Machine Co., Alliance, O.
Brown Hoisting Machinery Co., Cleveland, O.
Industrial Works, Bay City, Mich.
McMyler Interstate Co., Cleveland, O.
Niles-Bement-Pond Co., New York, N. Y.
Ridgway, Craig, & Son, Coatesville, Pa.
Shaw Electric Crane Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Locomotive.)
Brown Hoisting Machinery Co., Cleveland, O.
Browning Co., The, Cleveland, O.
Industrial Works, Bay City, Mich.
McMyler Interstate Co., Cleveland, O.
Orton & Steinbrenner Co., Chicago, Ill.
Wellman-Seaver-Morgan Co., Cleveland, O.

CRANES.
(Pneumatic.)
Detroit Hoist & Machinery Co., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Special.)
Alliance Machine Co., Alliance, O.
Brown Hoisting Machinery Co., Cleveland, O.
Euclid Crane & Hoist Co., Euclid, O.
Industrial Works, Bay City, Mich.
McMyler Interstate Co., Cleveland, O.
Shaw Electric Crane Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CRANES.
(Steam and Pneumatic, Wire Mills.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

CRANK SHAFTS.
Kropp Forge Co., Chicago, Ill.
Norton Grinding Co., Worcester, Mass.

CRAYONS.
(Marking.)
Weber-Erickson-Bunting Co., Pittsburgh, Pa.

CRUCIBLES.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

CRUSHERS.
Chalmers & Williams, Chicago Heights, Ill.

CRUSHERS.
(Disc.)
Chalmers & Williams, Chicago Heights, Ill.

CRUSHERS.
(Gyratory.)
Chalmers & Williams, Chicago Heights, Ill.

CRUSHERS.
(Jaw.)
Chalmers & Williams, Chicago Heights, Ill.

CUPOLAS.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

CUPRO-VANADIUM.
American Vanadium Co., Pittsburgh, Pa.

CUTTERS.
(Milling.)
Morse Twist Drill & Mch. Co., New Bedford, Mass.

CUTTING.
(Electric Arc.)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CUTTING.
(Oxy-Acetylene Process.)
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

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Malleable and Gray Iron

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Quality Unsurpassed BUFFALO, N. Y.

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STANDARD FOUNDRY CO.
BUFFALO, N. Y.

Atlas Steel Casting Company
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National Tube Co., Pittsburgh, Pa.
DERRICKS.
American Bridge Co., New York, N. Y.
Dake Engine Co., Grand Haven, Mich.
DIES.
American Vanadium Co., The, Pittsburgh, Pa.
Jones & Lamson Mach. Co., Springfield, Mass.
Landis Machine Co., Waynesboro, Pa.
Lansing Stamping & Tool Co., Lansing, Mich.
Long & Allstatter Co., Hamilton, O.
DIES.
(Thread Cutting.)
Modern Tool Co., Erie, Pa.
Toledo Machine & Tool Co., Toledo, O.
DIES.
(Self-Opening.)
Modern Tool Co., Erie, Pa.
DIE-PLATES AND WORLDES.
(Steel Wire Mills.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
DOCKS.
(Ore.)
American Bridge Co. New York, N. Y.
DOLOMITE.
(Double-dead, Burned Roasted.)
Davison, Allen S., Company, Pittsburgh, Pa.
DREDGES.
Thew Automobile Shovel Co., Lorain, O.
DRESSING.
(Belt.)
Dixon, Jos., Crucible Co., Jersey City, N. J.
DRILLS.
American Vanadium Co., The, Pittsburgh, Pa.
Cleveland Twist Drill Co., Cleveland, O.
DRILLS.
(Electric.)
Van Dorn & Dutton Co., Cleveland, O.
DRILLS.
(High Speed.)
McKenna Brothers, Pittsburgh, Pa.
DRILLS.
(Multiple.)
Baush Machine Tool Co., Springfield, Mass.
DRILLS.
(Pneumatic.)
Allen, John F., Co., New York, N. Y.
Cleveland Pneumatic Tool Co., Cleveland, O.
DRILLS.
(Portable.)
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
DRILLS.
(Twist.)
Morse Twist Drill & Machine Co., New Bedford, Mass.
Ryerson, Jos. T., & Son, Chicago, Ill.
DRIVERS.
(Pile.)
Industrial Works, Bay City, Mich.
DUST ARRESTING SYSTEMS.
Pangborn Corporation, Hagerstown, Md.
Whiting Foundry Equipment Co., Harvey, Ill.
DYNAMOS.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
EFFICIENCY DEVICES.
(Time Study Watches.)
Silberberg, M. J., Chicago, Ill.
ELECTRIC WELDERS.
Detroit Electric Welder Co., Detroit, Mich.
ELECTRICAL INSTRUMENTS.
(Repaired and Tested.)
Stupakoff Laboratories, Pittsburgh, Pa.
ELEVATORS.
Ridgway & Son, Craig, Coatesville, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.
ENGINEERS.
(Consulting.)
Duff, Samuel E., Pittsburgh, Pa.
ENGINEERS AND CONTRACTORS.
Abramsen Engineering Co., Pittsburgh, Pa.
Alliance Structural Co., Alliance, O.
American Bridge Co., New York, N. Y.
Blair Engineering Co., Chicago, Ill.
Eichleay, John Jr., Co., Pittsburgh, Pa.
Hartman, W. E., Chicago, Ill.
Hunt, Robert W., & Co., Chicago, Ill.
Laughlin, Alex., & Co., Pittsburgh, Pa.
Lehigh Clutch Co., Camden, N. J.
McClintic-Marshall Co., Pittsburgh, Pa.
McClure, Geo. W., Son & Co., Pittsburgh, Pa.
McKee, Arthur G., & Co., Cleveland, O.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Searing & Coultas, Pittsburgh, Pa.
Smythe, S. R., The, Co., Pittsburgh, Pa.
Swindell, Wm., & Bros., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
United Engrg & Fdy. Co., Pittsburgh, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.
ENGINEERS AND CONTRACTORS.
(By-Product Coke Ovens.)
Hartman, W. E., Chicago, Ill.
ENGINES.
(Blowing.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.

ENGINES.
(Corliss.)
Cooper, C. & G., Co., Mt. Vernon, O.
Mesta Machine Co., Pittsburgh, Pa.
ENGINES.
(Gas, Gasoline and Oil.)
Cooper, C. & G., Co., Mt. Vernon, O.
Mesta Machine Co., Pittsburgh, Pa.
Nat'l Transit Pump & Mch. Co., Oil City, Pa.
Tod, Wm., Co., Youngstown, O.
ENGINES.
(Hoisting.)
Dake Engine Co., Grand Haven, Mich.
Mead-Morrison Mfg. Co., East Boston, Mass.
Vulcan Iron Works, Wilkesbarre, Pa.
ENGINES.
(Pumping.)
Tod, Wm., Co., Youngstown, O.
ENGINES.
(Reversing.)
Mesta Machine Co., Pittsburgh, Pa.
ENGINES.
(Steam.)
Cooper, C. & G., Co., Mt. Vernon, O.
Dake Engine Co., Grand Haven, Mich.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Phoenix Iron Works Co., Meadville, Pa.
Tod, Wm., Co., Youngstown, O.
Vulcan Iron Works, Wilkesbarre, Pa.
ENGRAVERS.
(Steel and Copper Plate.)
Wiggins Co., John B., Chicago, Ill.
EQUIPMENT.
(Lighting Plant.)
Crocker-Wheeler Co., Ampere, N. J.
Smith Gas Power Co., The, Lexington, O.
EQUIPMENT.
(Rolling Mill.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
EQUIPMENT.
(Welded Chain, Wire and Wire Nail Mills—Complete.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
EXHAUST SYSTEMS.
Pangborn Corporation, Hagerstown, Md.
EXHAUSTERS.
(Gas.)
Connersville Blower Co., The, Connersville, Ind.
EXTRACTORS.
(Tar.)
Smith Gas Power Co., The, Lexington, O.
EYEBARS.
American Bridge Co., New York, N. Y.
FACINGS.
(Foundry.)
Dixon, Jos., Crucible Co., Jersey City, N. J.
FENCING.
Cambria Steel Co., Philadelphia, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.
FERRO ALLOYS.
(Vanadium.)
American Vanadium Co., Pittsburgh, Pa.
FERRO-CARBON TITANIUM.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
FERRO-MANGANESE.
Blackwell, Geo. G., & Sons, Ltd., Liverpool, England.
Mohr, J. J., & Son, Philadelphia, Pa.
Pickands, Brown & Co., Chicago, Ill.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.
FERRO-SILICON.
Blackwell, Geo. G., & Sons, Ltd., Liverpool, England.
Davison, Allen S., Company, Pittsburgh, Pa.
Mohr, J. J., & Son, Philadelphia, Pa.
Pickands, Brown & Co., Chicago, Ill.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
FERRO-TUNGSTEN.
Vanadium Alloys Steel Co., Pittsburgh, Pa.
Davison, Allen S., Co., Pittsburgh, Pa.
FERRO-VANADIUM.
American Vanadium Co., Pittsburgh, Pa.
Davison, Allen S., Co., Pittsburgh, Pa.
FILES.
Barnett, G. & H., Co., Philadelphia, Pa.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Nicholson File Co., Providence, R. I.
FIRE BRICK CONSTRUCTION.
Brown, P. J., Construction Co., Cleveland, O.
FITTINGS.
(Pipe.)
Illinois Malleable Iron Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
FLANGE PACKINGS.
(Leather.)
Graton & Knight Mfg. Co., The, Worcester, Mass.
FLANGES.
(Pipe.)
Dart, E. M., Mfg. Co., Providence, R. I.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.
FLASKS.
Sterling Wheelbarrow Co., Milwaukee, Wis.

FLAT WIRE—FLAT COLD ROLLED STEEL.
American Steel & Wire Co., Chicago, Ill.
FLOORING.
(Bridge.)
Youngstown Iron & Steel Co., Youngstown, O.
FLOORING.
(Creosoted Wood.)
Pittsburgh Wood Preserving Co., Pittsburgh.
FLUOR-SPAR.
Rogers, Brown & Co., Cincinnati, O.
FLY WHEELS.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
FORGINGS.
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Rolling Mill Co., Middletown, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Champion Mch. & Forging Co., Cleveland, O.
Columbus Forge & Iron Co., Columbus, O.
Drop Forging Co. of N. Y., Jersey City, N. J.
Eccles, Richard, Co., Auburn, N. Y.
Ingalls-Shepard Forging Co., Chicago, Ill.
Kropp Forge Co., Chicago, Ill.
Leard, Wm. E., New Brighton, Pa.
Otis Steel Co., Cleveland, O.
Rockford Drop Forge Co., Rockford, Ill.
FORGINGS.
(Auto.)
Cortland Forging Co., Cortland, N. Y.
General Drop Forge Co., Buffalo, N. Y.
Kropp Forge Co., Chicago, Ill.
FORGINGS.
(Bronze.)
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
FORGINGS.
(Car and Locomotive.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
FORGINGS.
(Copper and Alloy Steel.)
Kropp Forge Co., Chicago, Ill.
FORGINGS.
(Drop.)
Champion Mach. & Forging Co., Cleveland, O.
Columbus Forge & Iron Co., Columbus, O.
Drop Forging Co. of N. Y., Jersey City, N. J.
Eccles, Richard, Co., Auburn, N. Y.
General Drop Forge Co., Buffalo, N. Y.
Ingalls-Shepard Forging Co., Chicago, Ill.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Rockford Drop Forge Co., Rockford, Ill.
FORGINGS.
(Heat Treated.)
Carnegie Steel Co., Pittsburgh, Pa.
FORGINGS.
(Special.)
Cortland Forging Co., Cortland, N. Y.
FORGINGS.
(Steel.)
Carnegie Steel Co., Pittsburgh, Pa.
FORGINGS.
(Vanadium.)
American Vanadium Co., The, Pittsburgh, Pa.
FOUNDRY EQUIPMENT AND SUPPLIES.
(Iron and Brass.)
Arcade Mfg. Co., Freeport, Ill.
Pangborn Corporation, Hagerstown, Md.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.
FRICTION CLUTCH.
Lehigh Clutch Co., The, Camden, N. J.
FUEL OIL.
Texas Company, The, New York City.
FURNACE INSULATION.
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(Annealing.)
Hagan, Geo. J., Pittsburgh, Pa.
Quigley Furnace & Fdy. Co., New York, N. Y.
Swindell & Bros., Wm., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.
FURNACES.
(Billet and Plate Heating.)
Quigley Furnace & Fdy. Co., New York, N. Y.
FURNACES.
(Blast.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
McClure, Son & Co., G. W., Pittsburgh, Pa.
McKee, Arthur G., & Co., Cleveland, O.
Mt. Vernon Bridge Co., Mt. Vernon, O.
Muskegon Boiler Works, Muskegon, Mich.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Wellman-Seaver-Morgan Co., Cleveland, O.
FURNACES.
(Crucible.)
Laughlin & Co., Alex., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.
FURNACES.
(Forging.)
Quigley Furnace & Foundry Co., New York, N. Y.
FURNACES.
(Heat Testing.)
Quigley Furnace & Foundry Co., New York, N. Y.
FURNACES.
(Lead, Pot and Muffle Annealing, Wire Mills.)
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Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

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(Open-Hearth.)
Smythe, S. R., Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES.
(Reheating.)
Morgan Construction Co., Worcester, Mass.

FURNACES.
(Shrapnel.)
Railway Materials Co., Chicago, Ill.

FURRING.
(Metal.)
Youngstown Iron & Steel Co., Youngstown, O.

GAGES.
(Hydraulic.)
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

GAS PUMPS AND BOOSTERS.
Connersville Blower Co., The, Connersville, Ind.

GAS PRODUCERS.
Chapman Engineering Co., Mt. Vernon, O.
Hagan, Geo. J., Co., Pittsburgh, Pa.
Koppers, H., Co., Pittsburgh, Pa.
Morgan Const. Co., Worcester, Mass.
Smith Gas Power Co., The, Lexington, O.
Wellman-Seaver-Morgan Co., Cleveland, O.

GAS RECOVERY COKE OVENS.
Koppers, H., Co., Pittsburgh, Pa.

GASKETS.
(Leather.)
Graton & Knight Mfg. Co., The, Worcester, Mass.

GEARS AND GEAR CUTTING.
(Iron and Steel.)
American Steel Foundries, Chicago, Ill.
American Vanadium Co., The, Pittsburgh, Pa.
Bilgram Machine Works, Philadelphia, Pa.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Dake Engine Co., Grand Haven, Mich.
Farrell Foundry & Machine Co., Ansonia, Ct.
Fawcus Machine Co., Pittsburgh, Pa.
Horsburg & Scott Co., Cleveland, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Mesta Machine Co., The, Pittsburgh, Pa.
Nat'l Transit Pump & Mch. Co., Oil City, Pa.
New Process Gear Corpn., Syracuse, N. Y.
Newton Machine Tool Works, Inc., Philadelphia, Pa.
Nuttall, R. D., Co., Pittsburgh, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Todd, William, Co., Youngstown, O.
United Engineering & Fdy. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

GEARS.
(Rawhide.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Horsburgh & Scott Co., Cleveland, O.
New Process Gear Corpn., Syracuse, N. Y.
Nuttall, R. D., Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

GENERATORS.
(Direct and Alternating.)
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GENERATORS.
(Hydrogen.)
International Oxygen Co., New York, N. Y.

GENERATORS.
(Oxygen.)
International Oxygen Co., New York, N. Y.

GLOVES.
(Sand Blast.)
Pangborn Corporation, Hagerstown, Md.

GRAPHITE.
Dixon, Jos., Crucible Co., Jersey City, N. J.

GRATES.
Green Engrg. Co., Chicago, Ill.

GREASES.
Texas Company, The, New York City.

GRINDERS.
(Cylindrical.)
Modern Tool Co., Erie, Pa.

GRINDERS.
(Chain Die, Welded Chain Factories.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

GRINDERS.
(Crank Shaft.)
Modern Tool Co., Erie, Pa.

GRINDERS.
(Die.)
Modern Tool Co., Erie, Pa.

GRINDERS.
(Electrical Driven.)
Cincinnati Electrical Tool Co., Cincinnati, O.

GRINDERS.
(Nail Machines, Knife, Wire Nail Mills.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

GRINDERS.
(Ore.)
Chalmers & Williams, Chicago Heights, Ill.

GRINDERS.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.

GRINDERS.
(Universal.)
Modern Tool Co., Erie, Pa.

GRINDING MACHINERY.
Norton Grinding Co., Worcester, Mass.

GRINDING WHEEL STAND.
(Bench Type.)
Norton Grinding Co., Worcester, Mass.

GRINDING WHEEL STAND.
(Floor Type.)
Norton Grinding Co., Worcester, Mass.

HAMMERS.
(Belt-Driven.)
Beaudry Co., Inc., Boston, Mass.
Caldwell, E. R., & Co., Bradford, Pa.

HAMMERS.
(Drop.)
Alliance Machine Co., Alliance, O.
Bliss, E. W., Co., Brooklyn, N. Y.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Toledo Machine & Tool Co., Toledo, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

HAMMERS.
(Drop Forging.)
Buffalo Foundry & Mach. Co., Buffalo, N. Y.
Toledo Machine & Tool Co., Toledo, O.

HAMMERS.
(Foot and Power, Welded Chain Factories.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

HAMMERS.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.
Ryerson, Joseph T., & Son, Chicago, Ill.

HAMMERS.
(Power.)
Beaudry & Co., Inc., Boston, Mass.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Caldwell, E. R., & Co., Bradford, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Mayer Bros. Co., Mankato, Minn.
Toledo Machine & Tool Co., Toledo, O.

HAMMERS.
(Rawhide.)
Chicago Rawhide Mfg. Co., Chicago, Ill.

HAMMERS.
(Steam.)
Buffalo Fdy. & Mach. Co., Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York, N. Y.

HAND LEATHERS.
Graton & Knight Mfg. Co., The, Worcester, Mass.

HANGERS.
New Departure Mfg. Co., Bristol, Conn.

HEADS.
(Dished.)
Worth Bros., Coatesville, Pa.

HEAT TREATING.
Bidle, W. S., Co., Cleveland, O.
Steel Improvement Co., Cleveland, O.

HELMETS.
(Sand Blast.)
Pangborn Corporation, Hagerstown, Md.

HOISTS.
(Chain.)
Chisholm & Moore Mfg. Co., Cleveland, O.
Dake Engine Co., Grand Haven, Mich.

HOISTS.
(Compressed Air Geared.)
Dake Engine Co., Grand Haven, Mich.
Detroit Hoist & Machine Co., Detroit, Mich.
Whiting Fdy. Equipment Co., Harvey, Ill.

HOISTS.
(Electric.)
Alliance Machine Co., Alliance, O.
Browning Co., The, Cleveland, O.
Detroit Hoist & Mach. Co., Detroit, Mich.
Euclid Crane & Hoist Co., Euclid, O.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

HOISTS.
(Hydraulic.)
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

HOISTS.
(Pneumatic.)
Dake Engine Co., Grand Haven, Mich.
Detroit Hoist & Machine Co., Detroit, Mich.
Ridgway & Son, Craig, Coatesville, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

HOOPS AND BANDS.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.

HOSE.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.

HOSE.
(Sand Blast.)
Pangborn Corporation, Hagerstown, Md.

HOTELS.
Hotels Statler, Buffalo, Cleveland, Detroit.

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Graton & Knight Mfg. Co., The, Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

HYDROGEN.
International Oxygen Co., New York, N. Y.

INGOTS.
(Steel.)
Pennsylvania Products Co., Pine Forge, Pa.

INSPECTORS.
Hunt, Robert W., & Co., Chicago, Ill.

INSTRUMENTS.
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Brown Instrument Co., Philadelphia, Pa.
Smith Gas Power Co., The, Lexington, O.

INSULATION.
(Furnaces, Boiler Settings, Oven, Steam Pipe, Etc.)
Armstrong Cork Company, Pittsburgh, Pa.

INSULATING BRICK.
Armstrong Cork Co., Pittsburgh, Pa.

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Southwark Fdy. & Mch. Co., Philadelphia, Pa.

IRON.
(Cutting Apparatus.)
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
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IRON.
(Pig.)
(See Pig Iron.)

IRON.
(Staybolt.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., The, Cleveland, O.

IRON.
(Vanadium.)
American Vanadium Co., The, Pittsburgh, Pa.

IRON AND STEEL.
(Galvanized.)
Bourne-Fuller Co., The, Cleveland, O.
McCalla, Harold, Philadelphia, Pa.
Newport Rolling Mill Co., Newport, Ky.
Ryerson, Jos. T., & Son, Chicago, Ill.
Whitaker-Glessner Co., Portsmouth Wks., Portsmouth, O.
Youngstown Sheet & Tube Co., Youngstown, O.

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(Norway and Swedish.)
Bourne-Fuller Co., The, Cleveland, O.
Scully Steel & Iron Co., Chicago, Ill.

IRON AND STEEL.
(Scrap.)
American Bridge Co., New York, N. Y.

IRON AND STEEL.
(Vanadium.)
American Vanadium Co., The, Pittsburgh, Pa.

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(Hydraulic.)
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Watson-Stillman Co., New York, N. Y.

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Carnegie Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

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Moltrup Steel Products Co., Beaver Falls, Pa.

KEYS AND COTTERS.
(Machine.)
Standard Gauge Steel Co., Beaver Falls, Pa.

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Mitts & Merrill, Saginaw, Mich.

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(Cement.)
Freeman, S., & Sons Mfg. Co., The, Racine, Wis.

KNIVES.
(Shear.)
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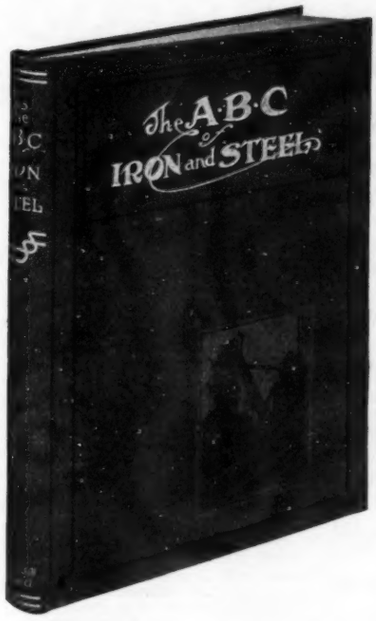

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Whiting Foundry Equipment Co., Harvey, Ill.

LADLES.
(Blast Furnace.)
Freeman, S., & Sons Mfg. Co., The, Racine, Wis.

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(Arc.)
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

LAMPS.
(Incandescent.)
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

LAMPS.
(Flare.)
Prest-O-Lite Co., The, Indianapolis, Ind.

LATH.
(Expanded Metal.)
Youngstown Iron & Steel Co., Youngstown, O.

LATHES.
Cincinnati Iron & Steel Co., Cincinnati, O.
Jones & Lamson Mach. Co., Springfield, Vt.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Niles-Bement-Pond Co., New York, N. Y.

LATHES.
(Roll.)
Mesta Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Niles-Bement-Pond Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mach. Co., Youngstown, O.

LATHES.
(Turret.)
Jones & Lamson Mach. Co., Springfield, Vt.
New Britain Mach. Co., New Britain, Conn.
Niles-Bement-Pond Co., New York, N. Y.

LEATHER.
(Hydraulic.)
Williams, I. B., & Sons, Dover, N. H.

LEATHER BELTING.
(Steam and Waterproof.)
Graton & Knight Mfg. Co., The, Worcester, Mass.

LETTERHEADS.
(Engraved.)
Wiggins, John B., Co., Chicago, Ill.

LINE MATERIAL.
(Telegraph and Telephone.)
National Tube Co., Pittsburgh, Pa.

LINING.
(Cupola.)
Louisville Fire Brick Works, Highland Park, Ky.
Mutton Hollow Fire Brick Co., The, Woodbridge, N. J.

LINING.
(Forge and Furnace.)
Harbison-Walker Refractories Co., Pittsburgh.

LOCOMOTIVES.
Atlas Car & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Vulcan Iron Works, Wilkesbarre, Pa.

LOCOMOTIVES.
(Electric.)
Atlas Car & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LOCOMOTIVES.
(Industrial.)
Vulcan Iron Works, Wilkesbarre, Pa.

LUBRICANTS.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Texas Company, The, New York City.

LUBRICATING OILS.
Texas Company, The, New York City.

LUMBER.
(Boxing, Crating, Flask and Pattern.)
Betts, Anson G., & Copmany, Asheville, N. C.
Johnson Lumber Co., Milwaukee, Wis.

MACHINE KEYS.
Leard, Wm. E., New Brighton, Pa.

MACHINE WORK.
Hill Pump Valve Co., Chicago, Ill.
Klotz Machine Co., Sandusky, O.
Reed Fdy. & Machine Co., Kalamazoo, Mich.
Western Pattern & Mfg. Co., Moline, Ill.

MACHINERY.
(Automatic Gear Cutting.)
Newton Mch. Tool Works, Inc., Philadelphia, Pa.

MACHINERY.
(Barb Wire Fence, Barb Nail Wire, Wire Mills.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

MACHINERY.
(Bending and Straightening.)
Bertsch & Co., Cambridge City, Ind.
Birdsboro Steel Fdy. & Mach. Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Long & Allstatter Co., Hamilton, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
United Engineering & Fdy. Co., Pittsburgh.
Watson-Stillman Co., New York, N. Y.

MACHINERY.
(Bolt and Nut.)
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, O.
Newton Mach. Tool Works, Inc., Philadelphia.
Williams Tool Co., Erie, Pa.

MACHINERY.
(Boring and Turning.)
Baker Bros., Toledo, O.
Cincinnati Planer Co., Cincinnati, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Mitts & Merrill, Saginaw, Mich.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.
Warner & Swasey Co., Cleveland, O.

MACHINERY.
(Cement.)
Vulcan Iron Works, Wilkesbarre, Pa.

MACHINERY.
(Coal and Ash Handling.)
Orton & Steinbrenner Co., Chicago, Ill.

MACHINERY.
(Coil and Trace Chain, Welded Chain Factories.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

MACHINERY.
(Coping.)
Newton Mch. Tool Wks., Inc., Philadelphia.

MACHINERY.
(Crushing.)
Chalmers & Williams, Chicago Heights, Ill.
Vulcan Iron Works, Wilkesbarre, Pa.

MACHINERY.
(Cutting Off—Cold Metal.)
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Newton Mach. Tool Wks., Inc., Philadelphia.

MACHINERY.
(Drilling.)
Baush Machine Tool Co., Springfield, Mass.
National Machinery Co., The, Tiffin, O.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.

MACHINERY.
(Drilling and Boring, Horizontal.)
Newton Mach. Tool Works, Inc., Philadelphia, Pa.

MACHINERY.
(Drilling, Multiple.)
Baush Machine Tool Co., Springfield, Mass.
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York, N. Y.

MACHINERY.
(Drilling, Radial.)
Baush Machine Tool Co., Springfield, Mass.
Newton Mach. Tool Wks., Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York, N. Y.

MACHINERY.
(Electrical.)
Moore, Edgar M., & Co., Pittsburgh, Pa.

MACHINERY.
(Electric Welding.)
Thomson Electric Welding Co., Lynn, Mass.
Toledo Electric Welder Co., Toledo, O.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

MACHINERY.
(Elevating and Conveying.)
Brown Hoisting Machinery Co., Cleveland, O.
McMyler Interstate Co., Cleveland, O.
Mead-Morrison Mfg. Co., East Boston, Mass.
Vulcan Iron Works, Wilkesbarre, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.

MACHINERY.
(Forging.)
Bethlehem Steel Co., South Bethlehem, Pa.
Bliss, E. W., Co., Brooklyn, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

MACHINERY.
(Galvanizing.)
Erie Foundry Co., Erie, Pa.

MACHINERY.
(Gear Cutting.)
Bilgram Machine Works, Philadelphia, Pa.
Newton Mach. Tool Works, Inc., Philadelphia.

MACHINERY.
(Grinding.)
Blake & Johnson Co., Waterbury, Conn.
Newton Mch. Tool Works, Inc., Philadelphia.
Norton Grinding Co., Worcester, Mass.

MACHINERY.
(Hydraulic.)
Mesta Machine Co., Pittsburgh, Pa.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.

MACHINERY.
(Milling.)
Cincinnati Milling Mach. Co., Cincinnati, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Newton Mch. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.
Warner & Swasey Co., Cleveland, O.

MACHINERY.
(Mining.)
McMyler Interstate Co., Cleveland, O.
Thew Automatic Shovel Co., Lorain, O.

MACHINERY.
(Molding.)
Arcade Mfg. Co., Freeport, Ill.

MACHINERY.
(Natural Gas.)
Moore, Edgar M., & Co., Pittsburgh, Pa.

MACHINERY.
(Nut Facing.)
Newton Mach. Tool Wks., Inc., Philadelphia.

MACHINERY.
(Pipe Mill.)
Landis Machine Co., Waynesboro, Pa.
Standard Engineering Co., Ellwood City, Pa.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Williams Tool Co., Erie, Pa.

MACHINERY.
(Pipe Threading.)
Oster Mfg. Co., The, Cleveland, O.

MACHINERY
(Planing.)
Newton Mch. Tool Wks., Inc., Philadelphia.

MACHINERY.
(Power Transmission.)
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

MACHINERY.
(Rolling Mill.)
Abramsen Engrg. Co., Pittsburgh, Pa.
Alliance Machine Co., Alliance, O.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blake & Johnson Co., Waterbury, Conn.
Farrell Foundry & Mach. Co., Ansonia, Conn.
Fawcus Machine Co., Pittsburgh, Pa.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hilles & Jones, Wilmington, Del.
Hyde Park Fdy. & Mch. Co., Hyde Park, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Morgan Engineering Co., Alliance, O.
Newbold, R. S., & Son Co., Norristown, Pa.
Standard Engineering Co., Ellwood City, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.
Wheeling Mold & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mch. Co., Youngstown, O.

MACHINERY.
(Screw Making, Automatic.)
Cook, Asa S., Co., Hartford, Conn.

MACHINERY.
(Second Hend.)
Baird Machy. Co., Pittsburgh, Pa.
Bath, Cyril J., Cleveland, O.
Moore, Edgar M., & Co., Pittsburgh, Pa.
New River Co., The, MacDonald, W. Va.
Niles-Bement-Pond Co., New York, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Stewart, A. P., Pittsburgh, Pa.

MACHINERY.
(Shearing.)
Erie Foundry Co., Erie, Pa.
Hilles & Jones, Wilmington, Del.
Mesta Machine Co., Pittsburgh, Pa.

MACHINERY.
(Sheet Metal Working.)
Bliss, E. W., Co., Brooklyn, N. Y.

MACHINERY.
(Steam.)
Moore, Edgar M., & Co., Pittsburgh, Pa.

MACHINERY.
(Tapping.)
Baker Bros., Toledo, O.

MACHINERY.
(Thread Rolling.)
Blake & Johnson Co., Waterbury, Conn.

MACHINERY.
(Tin House.)
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

MACHINERY.
(Wire.)
Blake & Johnson Co., Waterbury, Conn.

See Index to Advertisements for pages containing advertisements of companies listed above

MACHINERY.
(Wire Drawing, Wire and Rivet Works.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

MACHINERY.
(Wire Galvanizing, Wire Tinning, Wire Nails.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

MACHINERY.
(Wire Nail.)
National Machinery Co., Tiffin, O.

MACHINERY.
(Wire Nails and Staples, Wire Nail Mills.)
Kilby Mfg. Co., Cleveland, O.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

MACHINISTS.
(Special Machinery.)
Bethlehem Steel Co., South Bethlehem, Pa.
Blake & Johnson Co., Waterbury, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Dake Engine Co., Grand Haven, Mich.
Fawcus Machine Co., Pittsburgh, Pa.
Kilby Mfg. Co., Cleveland, O.
Long & Allstatter Co., Hamilton, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engrg. Co., Alliance, O.
Tod, Wm., Co., Youngstown, O.
Toledo Machine & Tool Co., Toledo, O.
Torrington Mfg. Co., Torrington, Conn.

MAGNESITE.
Stowe-Fuller Co., The, Cleveland, O.

MAGNESITE.
(Dead Burned.)
American Refractories Co., Chicago, Ill.

MAGNETS.
(Electric Lifting.)
Electric Controller & Mfg. Co., Cleveland, O.

MATCH PLATES.
Western Pattern & Mfg. Co., Moline, Ill.

MANUFACTURING SITES.
Industrial Corporation of Baltimore, Baltimore, Md.

METALS.
(Antimony, Copper.)
Blackwell, Geo. G., Sons & Co., Liverpool, Eng.

METALS.
(Babbitt.)
Lubricating Metal Co., The, New York City.

METAL.
(Bearing.)
Lubricating Metal Co., The, New York City.

METAL.
(Expanded.)
Youngstown Iron & Steel Co., Youngstown, O.

METAL.
(Infusion Process For.)
Steel Improvement Co., Cleveland, O.

METAL.
(Non-Ferrous.)
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

METAL.
(Perforated.)
Erdle Perforating Co., Rochester, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.

METAL.
(Sheet.)
Erdle Perforating Co., Rochester, N. Y.

METALS.
(Vanadium.)
American Vanadium Co., The, Pittsburgh, Pa.

METAL.
(Washed.)
Brier Hill Steel Co., The, Youngstown, O.

METALLURGISTS.
Steel Improvement Co., Cleveland, O.

METERS.
(Blast Volume.)
Clark, Chas. J., Chicago, Ill.

MILL AND MINE SUPPLIES.
Dake Engine Co., Grand Haven, Mich.

MILLS.
(Billet.)
Morgan Construction Co., Worcester, Mass.

MILLS.
(Blooming, Universal, Plate, Sheet, Tin, Bar.)
Mesta Machine Co., Pittsburgh, Pa.

MILLS.
(Continuous Rolling.)
Morgan Construction Co., Worcester, Mass.

MILLS.
(Wire Complete Equipment.)
Blake & Johnson Co., Waterbury, Conn.
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

MONEL METAL.
Williams & Company, Pittsburgh, Pa.

MOTORS.
(Air.)
Dake Engine Co., Grand Haven, Mich.
Detroit Hoist & Machine Co., Detroit, Mich.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

MOTORS.
(Electric D. C. and A. C.)
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Moore, Edgar M., & Co., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS.
(Mill.)
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOULDINGS.
(Cold Drawn.)
Interior Metal Mfg. Co., Jamestown, N. Y.

NAILS.
Jones & Laughlin Steel Co., Pittsburgh, Pa.

NAILS.
(Steel Cut.)
La Belle Iron Works, Steubenville, O.

NAILS.
(Wire.)
Cambria Steel Co., Philadelphia, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

NIPPLES.
National Tube Co., Pittsburgh, Pa.

NUTS.
American Bridge Co., New York, N. Y.
American Iron & Steel Co., Lebanon, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scully Steel & Iron Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.

NUTS.
(Hot Pressed.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Upson Nut Co., Cleveland, O.

ORE.
(Chrome.)
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, Eng.
Samuel, Frank, Philadelphia, Pa.

ORE.
(Iron.)
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, Eng.
Breitung, E. N., & Co., Cleveland, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Oglebay, Norton & Co., Cleveland, O.
Pennsylvania Products Co., Pine Forge, Pa.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Snyder, W. P., & Co., Pittsburgh, Pa.
Tod-Stambaugh Co., Cleveland O.

OVENS.
(Coke and By-Products Recovery.)
Koppers, H., Co., Pittsburgh, Pa.

OVENS.
(Core.)
Quigley Furnace & Foundry Co., New York.
Whiting Fdy. Equipment Co., Harvey, Ill.

OXYGEN.
International Oxygen Co., New York, N. Y.
Linde Air Products Co., New York City.

OXYGEN WELDING AND CUTTING APPARATUS.
International Oxygen Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.

PACKING.
(Metallic.)
Lubricating Metal Co., The, New York City.

PACKINGS.
(Leather.)
Graton & Knight Mfg. Co., Worcester, Mass.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

PAINT.
Dixon, Jos., Crucible Co., Jersey City, N. J.

PANELS.
(Current Limit, Protective.)
Electric Controller & Mfg. Co., Cleveland, O.

PANS.
(Grinding.)
Phillips & McLaren Co., Philadelphia, Pa.

PANS.
(Lathe.)
New Britain Machine Co., New Britain, Conn.

PANS.
(Shop.)
American Bridge Co., New York, N. Y.

PATTERNS.
Arcade Mfg. Co., Freeport, Ill.
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.
Klotz Machine Co., Sandusky, O.
Nordberg Mfg. Co., Milwaukee, Wis.

PATTERNS.
(Wood and Metal.)
Wellman Pattern-Supply Co., The, Cleveland.
Western Pattern & Mfg. Co., Moline, Ill.

PENSTOCKS.
Knox Pressed & Welded Steel Co., Pittsburgh.

PERFORATING.
(Sheet Metal, Automatic, Screen Work.)
Erdle Perforating Co., Rochester, N. Y.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

PIG IRON.
Baird & West, Detroit, Mich.
Barnum-Richardson Co., Lime Rock, Conn.
Bethlehem Steel Co., South Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Columbus Iron & Steel Co., Columbus, O.
Domhoff & Joyce Co., Cincinnati, O.
Eaton, Rhodes & Co., Cincinnati, O.
Globe Iron Co., The, Jackson, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons, Pittsburgh, Pa.
Illinois Steel Co., St. Louis, Mo.
Inland Steel Co., Chicago, Ill.
LaBelle Iron Works, Steubenville, O.
McKeefrey & Co., Leetonia, O.
Mitchell-Diggins Iron Co., Cadillac, Mich.
Mohr, J. J., & Son, Philadelphia, Pa.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Reliance Iron & Coke Co., Cincinnati, O.
Republic Iron & Steel Co., Youngstown, O.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.
Semet-Solvay Co., Syracuse, N. Y.
Snyder, W. P., & Co., Pittsburgh, Pa.
Stewart Iron Co., Ltd., Cleveland, O.
Struthers Furnace Co., The, Cleveland, O.
Superior Charcoal Iron Co., Grand Rapids, Mich.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Thomas Iron Co., Easton, Pa.
Upson Nut Co., Cleveland, O.

PILING.
(Steel Sheet Interlocking.)
Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

PINIONS.
(See Gears.)

PINS.
(Knuckle and Brake.)
Oliver Iron & Steel Co., Pittsburgh, Pa.

PINS.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

PIPE.
Bourne-Fuller Co., The, Cleveland, O.
Central Tube Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Republic Iron & Steel Co., Youngstown, O.
U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE.
(Drive, Iron and Steel.)
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

PIPE.
(Iron and Steel, Galvanized.)
National Tube Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE.
(Line, Iron and Steel.)
National Tube Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE.
(Riveted Steel.)
American Bridge Co., New York, N. Y.
Cambria Steel Co., Johnstown, Pa.
Muskegon Boiler Works, Muskegon, Mich.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

PIPE.
(Wrought Iron.)
Bourne-Fuller Co., The, Cleveland, O.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE COVERING.
(Steam and Cold Water.)
Armstrong Cork Company, Pittsburgh, Pa.

PIPE LINE FITTINGS.
Nat'l Transit Pump & Mch. Co., Oil City, Pa.

PIPE TAGS.
Weber-Erickson-Bunting Co., Pittsburgh, Pa.

PIPING.
(Power.)
Pittsburgh Piping & Equip. Co., Pittsburgh.

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PLANERS.
Cincinnati Planer Co., Cincinnati, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Niles-Bement-Pond Co., New York, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.

PLANTS.
(Electric Lighting.)
Smith Gas Power Co., The, Lexington, O.

PLANTS.
(Powdered Coal.)
Quigley Furnace & Foundry Co., New York, N. Y.

PLATES.
Allegheny Steel Co., Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnahan Tin Plate & Sheet Co., Canton, O.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Taylor, N. & G., Co., Philadelphia, Pa.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia, Pa.
Worth Bros. Co., Coatesville, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

PLATES.
(Boiler and Tank.)
American Rolling Mill Co., Middletown, O.
Bourne-Fuller Co., The, Cleveland, O.
Brown-Wales Co., Boston, Mass.
Carnegie Steel Co., Pittsburgh, Pa.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Otis Steel Co., Cleveland, O.
Ryerson & Son, Jos. T., Chicago, Ill.

PLATES.
(Felloe.)
Wrought Washer Mfg. Co., Milwaukee, Wis.

PLATES.
(Floor, Rolled Steel.)
Carnegie Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Wood, Alan, Iron & Steel Co., Philadelphia.

PLATES.
(Sheared.)
American Rolling Mill Co., Middletown, O.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.

PLATES.
(Steel.)
Pennsylvania Products Co., Pine Forge, Pa.

PLATES.
(Terne.)
American Sheet & Tin Plate Co., Pittsburgh.
Carnahan Tin Plate & Sheet Co., Canton, O.

PLATES.
(Tie.)
Illinois Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.

PLATES.
(Tin.)
American Sheet & Tin Plate Co., Pittsburgh.
Jones & Laughlin Steel Co., Pittsburgh, Pa.

PLATES.
(Universal.)
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
United Steel Co., Canton, O.
Youngstown Sheet & Tube Co., Youngstown, O.

PLATES.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

PLATE WORK.
(Steel.)
Muskegon Boiler Works, Muskegon, Mich.

PLATING.
(Nickel, Brass, Copper and Silver.)
Western Pattern & Mfg. Co., Moline, Ill.

POINTERS.
(Wire Rod, Wire Mills.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

POLES.
(Gin.)
American Bridge Co., New York, N. Y.

POTS.
(Galvanizing.)
American Bridge Co., New York, N. Y.

PRESSES.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., Brooklyn, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wood, R. D., & Co., Philadelphia, Pa.

PRESSES.
(Bending and Flanging.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Mesta Machine Co., Pittsburgh, Pa.

PRESSES.
(Drill, Heavy Duty.)
Niles-Bement-Pond Co., New York, N. Y.

PRESSES.
(Drill, Multiple Spindle.)
Niles-Bement-Pond Co., New York, N. Y.

PRESSES.
(Forging.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.

PRESSES.
(Hydraulic.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Southwark Fdy & Mch. Co., Philadelphia, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.

PRESSES.
(Power.)
Toledo Machine & Tool Co., Toledo, O.

PRESSES.
(Rail Straightening.)
Tod Co., Wm., Youngstown, O.

PRESSES.
(Steam, Sleeves, Runner Brick, Nozzle and Tuyeres, Fire Brick Works.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

PRESSES.
(Toggle Drawing.)
Toledo Machine & Tool Co., Toledo, O.

PRESSES.
(Trimming.)
Erie Foundry Co., Erie, Pa.
Toledo Machine & Tool Co., Toledo, O.

PRESSURE GAGES.
(Blast.)
Clark, Chas. J., Chicago, Ill.

PRINTERS.
(Plate.)
Wiggins, John B., Co., Chicago, Ill.

PRODUCERS.
(Gas.)
Koppers, H., Co., Pittsburgh, Pa.

PUMP LEATHERS.
Graton & Knight Mfg. Co., The, Worcester, Mass.

PUMPS.
Aldrich Pump Co., Allentown, Pa.
Deming Co., Salem, O.
Nat'l Transit Pump & Mch. Co., Oil City, Pa.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Tod, Wm., Co., Youngstown, O.

PUMPS.
(Air.)
Deming Company, Salem, O.

PUMPS.
(Boiler Feed.)
Aldrich Pump Co., Allentown, Pa.
Deming Co., Salem, O.
Vulcan Iron Works, Wilkesbarre, Pa.

PUMPS.
(Centrifugal.)
Dake Engine Co., Grand Haven, Mich.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

PUMPS.
(Circulating.)
Connersville Blower Co., The, Connersville, Ind.

PUMPS.
(Deep Well.)
Deming Co., Salem, O.

PUMPS.
(Electric Driven.)
Aldrich Pump Co., Allentown, Pa.
Deming Co., Salem, O.

PUMPS.
(Elevator.)
Aldrich Pump Co., Allentown, Pa.

PUMPS.
(Hydraulic.)
Aldrich Pump Co., Allentown, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Deming Co., Salem, O.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

PUMPS.
(Mine.)
Aldrich Pump Co., Allentown, Pa.
Deming Co., Salem, O.

PUMPS.
(Oil.)
Connersville Blower Co., The, Connersville, Ind.

PUMPS.
(Rotary.)
Connersville Blower Co., The, Connersville, Ind.

PUMPS.
(Vacuum.)
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Connersville Blower Co., The, Connersville, Ind.
Deming Co., Salem, O.
Mesta Machine Co., Pittsburgh, Pa.

PUNCHES AND SHEARS.
Allen, John F., Co., New York, N. Y.
Alliance Machine Co., Alliance, O.
Bertsch & Co., Cambridge City, Ind.
Bliss, E. W., Co., Brooklyn, N. Y.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Hilles & Jones, Wilmington, Del.
Long & Allstatter Co., Hamilton, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Bridge Tool Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.
Wood, R. D., & Co., Philadelphia, Pa.

PUNCHES.
(Hand.)
Bourne-Fuller Co., The, Cleveland, O.

PUNCHES.
(Hydraulic.)
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Watson-Stillman Co., New York, N. Y.

PUNCHES.
(Multiple.)
Bliss, E. W., Co., Brooklyn, N. Y.
Hilles & Jones, Wilmington, Del.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.

PUNCHES.
(Pneumatic.)
Allen, John F., Co., New York, N. Y.

PUNCHES.
(Structural and Boiler Work.)
Richards, I. P., Providence, R. I.

PYROMETERS.
Brown Instrument Co., Philadelphia, Pa.
Stupakoff Laboratories, Pittsburgh, Pa.
Thwing Instrument Co., Pittsburgh, Pa.

RACKS.
(Steel or Tool.)
New Britain Mach. Co., New Britain, Conn.

RAILROAD SUPPLIES.
U. S. Metal & Mfg. Co., New York City.

RAILS.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Hyman-Michaels Co., Chicago, Ill.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Lackawanna Steel Co., Buffalo, N. Y.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.

REAMERS.
Morse Twist Drill & Mach. Co., New Bedford, Mass.

RECORDERS.
Thwing Instrument Co., Pittsburgh, Pa.

REELS.
(Wood and Iron, Wire Mills.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

REGULATORS.
(Automatic Pressure.)
Electric Controller & Mfg. Co., Cleveland, O.

REGULATORS.
(Pressure and Vacuum.)
Connersville Blower Co., The, Connersville, Ind.

RELAYS.
(Field Rheostat.)
Electric Controller & Mfg. Co., Cleveland, O.

RESISTANCE.
(Cast Grid and Coil.)
Electric Controller & Mfg. Co., Cleveland, O.

RHEOSTATS.
(Motor Field, Motor Starting.)
Electric Controller & Mfg. Co., Cleveland, O.

RIM FRICTION CLUTCHES.
Lehigh Clutch Co., The, Camden, N. J.

See Index to Advertisements for pages containing advertisements of companies listed above

RIVETS.
(Structural, Boiler, Ship and Tank.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Progressive Mfg. Co., Torrington, Conn.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.

RIVETS.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

RIVETERS.
(Hydraulic.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Wood, R. D., & Co., Philadelphia, Pa.

RIVETERS.
(Pneumatic.)
Allen, John F., Co., New York, N. Y.
Cleveland Pneumatic Tool Co., Cleveland, O.
Ryerson, Jos. T., & Son, Chicago, Ill.

RODS.
(Connecting.)
Leard, Wm. E., New Brighton, Pa.

RODS.
(Drill, Polished.)
Bourne-Fuller Co., The, Cleveland, O.

RODS.
(Iron and Steel.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Upson Nut Co., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, O.

RODS.
(Rivet and Wire.)
Jones & Laughlin Steel Co., Pittsburgh, Pa.

RODS.
(Straightened and Cut.)
Youngstown Sheet & Tube Co., Youngstown, O.

ROLL GRINDING MACHINES.
Norton Grinding Co., Worcester, Mass.

ROLLS.
(Bending and Straightening.)
Bertsch & Co., Cambridge City, Ind.
Hilles & Jones, Wilmington, Del.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

ROLLS.
(Sand Chilled and Steel.)
American Steel Foundries, Chicago, Ill.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Farrell Fdy. & Mach. Co., Ansonia, Conn.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hyde Park Fdy. & Mch. Co., Hyde Park, Pa.
Mesta Machine Co., Pittsburgh, Pa.
National Roll & Foundry Co., Avonmore, Pa.
Seaman, Sleeth & Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mach. Co., Youngstown, O.

ROLLS.
(Wood.)
Dart, E. M., Mfg. Co., Providence, R. I.

ROOFING.
(Car, Metal, Galvanized, Plastic.)
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Newport Rolling Mill Co., Newport, Ky.
Stark Rolling Mill Co., Canton, O.

ROOFING.
(Composite.)
Texas Company, The, New York City.

ROOFING.
(Corrugated.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Brier Hill Steel Co., Youngstown, O.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sheet & Tube Co., Youngstown, O.

ROOFING.
(Iron and Steel.)
American Rolling Mill Co., Middletown, O.
American Sh't & Tin Plate Co., Pittsburgh.
Newport Rolling Mill Co., Newport, Ky.
Stark Rolling Mill Co., Canton, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Western Reserve Steel Co., Warren, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, O.

ROOFING.
(Rust Resisting.)
Stark Rolling Mill Co., Canton, O.

ROPE DRESSING.
Texas Company, The, New York City.

RUNNING BALANCE INDICATING MACHINE.
Norton Grinding Co., Worcester, Mass.

RUNWAYS.
(Crane.)
American Bridge Co., New York, N. Y.

SAND.
(Molding.)
Gordon Sand Co., Inc., The, Conneaut, O.

SAND BLAST.
(Chilled Shot for Use In.)
Globe Steel Co., Mansfield, O.

SAND BLAST EQUIPMENT AND ACCESSORIES.
Pangborn Corporation, Hagerstown, Md.
Wheeling Foundry Equipment Co., Harvey, Ill.

SAND BLAST SAND.
Pangborn Corporation, Hagerstown, Md.

SAND BLAST TUMBLING BARRELS.
Pangborn Corporation, Hagerstown, Md.

SAND CONVEYING MACHINERY.
Pangborn Corporation, Hagerstown, Md.

SAND DRYERS.
Pangborn Corporation, Hagerstown, Md.

SAWS.
(Band.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.

SAWS.
(Cold Metal.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.
Espen-Lucas Mch. Works, Philadelphia, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Newton Mach. Tool Wks., Inc., Philadelphia, Pa.

SAWS.
(Hack.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SAWS.
(Milling.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.

SAWS.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

SCRAP IRON.
U. S. Metal & Mfg. Co., New York City.

SCREENS.
Hendrick Mfg. Co., Carbondale, Pa.

SCREENS.
(Pulsating.)
Chalmers & Williams, Chicago Heights, Ill.

SCREENS.
(Revolving.)
Chalmers & Williams, Chicago Heights, Ill.

SCREW STOCK.
(Free Cutting.)
Columbia Steel & Shafting Co., Pittsburgh, Pa.

SCREWS.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Milton Mfg. Co., Milton, Pa.
Progressive Mfg. Co., Torrington, Conn.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

SEMI-UNIVERSAL GRINDING MACHINE.
Norton Grinding Co., Worcester, Mass.

SEPARATORS.
(Moisture and Oil.)
Pangborn Corporation, Hagerstown, Md.

SHAFTING.
American Vanadium Co., The, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Cumberland Steel Co., Cumberland, Md.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.

SHAFTING.
(Cold Drawn or Rolled.)
Bourne-Fuller Co., The, Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.

SHAFTING.
(Turned.)
Bourne-Fuller Co., The, Cleveland, O.

SHAPERS.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Newton Mch. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.

SHAPES.
(Agricultural.)
Carnegie Steel Co. Pittsburgh Pa.
Laclede Steel Co., St. Louis, Mo.
Republic Iron & Steel Co., Youngstown, O.

SHAPES.
(Automobile.)
Moltrup Steel Products Co., Beaver Falls, Pa.

SHAPES.
(Cold Drawn.)
Interior Metal Mfg. Co., Jamestown, N. Y.

SHAPES.
(Steel, Structural and Special Rolled.)
American Vanadium Co., The, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Scully Steel & Iron Co., Chicago, Ill.

SHEAR BLADES.
White, L. & I. J., Co., Buffalo, N. Y.

SHEARS.
(Angle and Plate.)
Bertsch & Co., Cambridge City, Ind.
Hilles & Jones, Wilmington, Del.

SHEARS.
(Billet, Bloom and Slab.)
Garrison, A., Foundry Co., Pittsburgh, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SHEARS.
(Doubling.)
Mesta Machine Co., Pittsburgh, Pa.

SHEARS.
(Flying and Bar.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.

SHEAR KNIVES.
White, L. & I. J. Co., Buffalo, N. Y.

SHEARS.
(Lever.)
Mesta Machine Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.
Youngstown Fdy. & Mch. Co., Youngstown.

SHEARS.
(Portable.)
Doelger & Kirsten, Milwaukee, Wis.
Watson-Stillman Co., New York, N. Y.

SHEARS.
(Power.)
Erie Foundry Co., The, Erie, Pa.
Toledo Machine & Tool Co., Toledo, O.

SHEARS.
(Scrap Alligator, Wire and Wire Nail Mills.)
Doelger & Kirsten, Milwaukee, Wis.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
Youngstown Fdy. & Mch. Co., Youngstown.

SHEARS.
(Squaring.)
Bliss Co., E. W., Brooklyn, N. Y.
Erie Foundry Co., Erie, Pa.
Garrison A., Foundry Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SHEARS.
(Vertical.)
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SHEETS.
(Automobile.)
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Newport Rolling Mill Co., Newport, Ky.

SHEETS.
(Black Steel.)
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Ryerson, Joseph T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Iron & Steel Co., Youngstown.
Youngstown Sheet & Tube Co., Youngstown.

SHEETS.
(Blue Annealed.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sheet & Tube Co., Youngstown.

SHEETS.
(Corrugated.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Ryerson, Joseph T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Trumbull Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Iron & Steel Co., Youngstown.
Youngstown Sheet & Tube Co., Youngstown.

SHEETS.
(Dead Soft for Stamping.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
La Belle Iron Works, Steubenville, O.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Iron & Steel Co., Youngstown.
Youngstown Sheet & Tube Co., Youngstown.

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SHEETS.
(Deep Drawing Stock.)
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
La Belle Iron Works, Steubenville, O.
Youngstown Iron & Steel Co., Youngstown.

SHEETS.
(Electric.)
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Newport Rolling Mill Co., Newport, Ky.

SHEETS.
(Galvanized.)
Allegheny Steel Co., Pittsburgh, Pa.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Trumbull Steel Co., Warren, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS.
(Iron and Steel.)
Allegheny Steel Co., Pittsburgh, Pa.
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
American Vanadium Co., The, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
Disston & Sons Inc., Henry, Philadelphia, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Newport Rolling Mill Co., Newport, Ky.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Trumbull Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia, Pa.
Worth Bros. Co., Coatesville, Pa.
Youngstown Sheet & Tube Co., Youngstown.

SHEETS.
(Open-Hearth.)
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Iron & Steel Co., Youngstown.

SHEETS.
(Pickled and Cold Rolled.)
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
Newport Rolling Mill Co., Newport, Ky.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Youngstown Sheet & Tube Co., Youngstown.

SHEETS.
(Polished.)
American Rolling Mill Co., Middletown, O.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
Carnahan Tin Plate & Sheet Co., Canton, O.

SHEETS.
(Roofing.)
Canton Sheet Steel Co., Canton, O.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.

SHEETS.
(Rust Resisting.)
Stark Rolling Mill Co., Canton, O.

SHEETS.
(Steel Box Annealed.)
Canton Sheet Steel Co., Canton, O.
La Belle Iron Works, Steubenville, O.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Iron & Steel Co., Youngstown.
Youngstown Sheet & Tube Co., Youngstown.

SHEETS.
(Toncan Metal.)
Stark Rolling Mill Co., Canton, O.

SHEET IRON WORK.
Hendrick Mfg. Co., Carbondale, Pa.

SHELVING.
(Steel.)
New Britain Mach. Co., New Britain, Conn.

SHOVELS.
(Steam.)
Thew Automatic Shovel Co., Lorain, O.

SHRAPNEL FURNACES.
Railway Materials Co., Chicago, Ill.

SIDING.
(Iron and Steel.)
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Newport Rolling Mill Co., Newport, Ky.

SIDING.
(Toncan Metal.)
Stark Rolling Mill Co., Canton, O.

SIFTERS.
(Sand.)
Arcade Mfg. Co., Freeport, Ill.
Whiting Fdy. Equipment Co., Harvey, Ill.

SLABS.
Cambria Steel Co., Philadelphia, Pa.
La Belle Iron Works, Steubenville, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SLABS.
(Sheet.)
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Youngstown Sh't & Tube Co., Youngstown, O.

SLABS.
(Soft, Open Hearth, Forging-Alloy.)
Central Steel Co., The, Massillon, O.

SOLENOIDS.
(Electric.)
Electric Controller & Mfg. Co., Cleveland, O.

SPECIALTIES.
(Metal.)
White, L. & I. J., Co., Buffalo, N. Y.

SPECIALTIES.
(Steam.)
National Tube Co., Pittsburgh, Pa.

SPIEGELEISEN.
Pickands, Brown & Co., Chicago, Ill.

SPIKES.
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Steel & Wire Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Republic Iron & Steel Co., Youngstown, O.

SPIKES.
(Dock and Railroad.)
Jones & Laughlin Steel Co., Pittsburgh, Pa.

SPIKES.
(Screw.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Illinois Steel Co., Chicago, Ill.

SPLICES.
(Rail.)
Carnegie Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Republic Iron & Steel Co., Youngstown, O.

SPRINGS.
Duer Spring & Mfg. Co., Pittsburgh, Pa.

SPRINGS.
(Automobile.)
Duer Spring & Mfg. Co., Pittsburgh, Pa.

SPRINGS.
(Vanadium.)
American Vanadium Co., Pittsburgh, Pa.

STACKS.
(Steel.)
American Bridge Co., New York, N. Y.
Freeman, S., & Sons Mfg. Co., The, Racine, Wis.
Muskegon Boiler Works, Muskegon, Mich.

STAMPINGS.
(Sheet Metal.)
Bettcher Mfg. Co., Cleveland, O.
Erdle Perforating Co., Rochester, N. Y.
Lansing Stamping & Tool Co., Lansing, Mich.

STAMPINGS.
(Sheet Steel.)
New Britain Mch. Co., New Britain, Conn.

STAND-PIPES.
Knox Pressed & Welded Steel Co., Pittsburgh.

STARTERS.
(Electric Motor.)
Crocker-Wheeler Co., Ampere, N. J.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

STARTERS.
(Electric Motor.) (Manual, Automatic.)
Electric Controller & Mfg. Co., Cleveland, O.

STEEL.
American Bridge Co., New York, N. Y.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
La Belle Iron Works, Steubenville, O.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
West Leechburg Steel Co., Pittsburgh, Pa.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia, Pa.
Youngstown Sh't & Tube Co., Youngstown, O.

STEEL.
(Alloy.)
Andrews Steel Company, Newport, Ky.
Boerder Process Steel Co., The, Toledo, O.
Central Steel Co., The, Massillon, O.

STEEL.
(Automobile.)
United Steel Co., Canton, O.

STEEL.
(Axle, Automobile, Mining Car.)
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
United Steel Co., Canton, O.

STEEL.
(Chrome Nickel.)
Central Steel Co., The, Massillon, O.

STEEL.
(Cold Drawn.)
Bourne-Fuller Co., The, Cleveland, O.
Columbia Steel & Shaft'g Co., Pittsburgh, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Standard Gauge Steel Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
United Steel Co., Canton, O.

STEEL.
(Cold Rolled.)
Bourne-Fuller Co., The, Cleveland, O.
Newport Rolling Mill Co., Newport, Ky.
Pittsburgh Cold Rolled Steel Co., Pittsburgh, Pa.
Scully Steel & Iron Co., Chicago, Ill.

STEEL.
(Electric.)
Illinois Steel Co., Chicago, Ill.

STEEL.
(Forging.)
United Steel Co., Canton, O.

STEEL.
(Gear.)
United Steel Co., Canton, O.

STEEL.
(High Grade—High Carbon.)
Central Steel Co., The, Massillon, O.

STEEL.
(High Speed.)
Bethlehem Steel Co., South Bethlehem, Pa.
Boerder Process Steel Co., The, Toledo, O.
Bourne-Fuller Co., The, Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Vanadium Alloys Steel Co., Pittsburgh, Pa.

STEEL.
(Manganese.)
Central Steel Co., The, Massillon, O.

STEEL.
(Nickel.)
Andrews Steel Company, Newport, Ky.
Central Steel Co., The, Massillon, O.
United Steel Co., Canton, O.

STEEL.
(Open-Hearth.)
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Union Drawn Steel Co., Beaver Falls, Pa.
Upson Nut Co., Cleveland, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.

STEEL.
(Rock Drill.)
Firth-Sterling Steel Co., McKeesport, Pa.

STEEL.
(Special Analysis.)
Andrews Steel Company, Newport, Ky.
Central Steel Co., The, Massillon, O.

STEEL.
(Spring.)
Firth-Sterling Steel Co., McKeesport, Pa.
United Steel Co., Canton, O.

STEEL.
(Structural.)
Alliance Structural Co., Alliance, O.
American Bridge Co., New York, N. Y.
Bellefontaine Bridge & Steel Co., The, Bellefontaine, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Eichleay, John Jr., Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.
McClintic-Marshall Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Chicago, Ill.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.

STEEL.
(Tool.)
Bethlehem Steel Co., South Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Ryerson, Joseph T., & Son, Chicago, Ill.
Vanadium Alloys Steel Co., Pittsburgh, Pa.

STEEL.
(Twisted.)
Bourne-Fuller Co., The, Cleveland, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Upson Nut Co., Cleveland, O.

STEEL.
(Vanadium.)
American Vanadium Co., Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
United Steel Co., Canton, O.

STEEL STAMPS.
Weber-Erickson-Bunting Co., Pittsburgh, Pa.

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STOKERS.
Babcock & Wilcox Co., The, New York City.
Erie Foundry Co., Erie, Pa.
Green Engineering Co., Chicago, Ill.

STOPS.
(Electric Limit.)
(For Cranes, etc.)
Electric Controller & Mfg. Co., Cleveland, O.

STOP WATCHES.
(Time Study.)
Silberberg, M. J., Chicago, Ill.

STRAP JOINTS.
Leard, Wm. E., New Brighton, Pa.

STRAIGHTENERS.
(Bar.)
Abramsen Engineering Co., Pittsburgh, Pa.

STUDDING.
(Metal.)
Youngstown Iron & Steel Co., Youngstown, O.

SUPERHEATERS.
(Steam.)
Babcock & Wilcox Co., The, New York City.

SUPPLIES.
(Well.)
National Tube Co., Pittsburgh, Pa.

SURFACE GRINDING MACHINE.
Norton Grinding Co., Worcester, Mass.

SWITCH BOARDS.
(For Cranes.)
Electric Controller & Mfg. Co., Cleveland, O.

SWITCHES.
(Automatic Float, Knife, Snap.)
Electric Controller & Mfg. Co., Cleveland, O.

SWITCHES.
(Electrical.)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SWITCHES.
(Magnetic.)
Electric Controller & Mfg. Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TABLES.
(Drawing.)
Economy Drawing Table Co., Toledo, O.

TABLES.
(Rotary Sand Blast.)
Pangborn Corporation, Hagerstown, Md.

TABLES.
(Rolling Mill.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

TABLES.
(Transfer.)
Industrial Works, Bay City, Mich.

TANKS AND TOWERS.
American Bridge Co., New York, N. Y.
Freeman, S., & Sons, Mfg. Co., The, Racine, Wis.
Knox Pressed & Welded Steel Co., Pittsburgh.
National Tube Co., Pittsburgh, Pa.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

TANKS.
(Acid and Chemical.)
Hauser-Stander Tank Co., The, Cincinnati, O.

TANKS.
(Water and Acid Storage, Wire Mills.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

TANKS.
(Wooden.)
Hauser-Stander Tank Co., The, Cincinnati, O.

THERMOMETERS.
Brown Instrument Co., Philadelphia, Pa.

TILE.
(Fire Clay, Furnace, Hollow, Etc.)
Union Mining Co., Mt. Savage, Md.

TIN.
(Roofing.)
American Sheet & Tin Plate Co., Pittsburgh, Pa.

TIN PLATE.
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Carnahan Tin Plate & Sheet Co., Canton, O.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Standard Tin Plate Co., Canonsburg, Pa.
Trumbull Steel Co., The, Warren, O.

TIRES.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

TITANIUM.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

TOOLS.
(Edge.)
White, L. & I. J., Co., Buffalo, N. Y.

TOOLS.
(Machinists.)
Morse Twist Drill & Mach. Co., New Bedford, Mass.

TOOLS.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.
Ryerson, Jos. T., & Son, Chicago, Ill.

TOOLS.
(Special Machinery.)
Lansing Stamping & Tool Co., Lansing, Mich.

TOOLS.
(Thread Cutting.)
Landis Machine Co., Waynesboro, Pa.

TORCHES, BLOW.
(Soldering and Brazing.)
Prest-O-Lite Co., The, Indianapolis, Ind.

TRACK.
(Industrial.)
Atlas Car & Mfg. Co., Cleveland, O.
Chase Foundry & Mfg. Co., Columbus, O.

TRAMRAILS.
(Overhead Systems.)
Brown Hoisting Machinery Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

TRAMWAYS.
American Steel & Wire Co., Chicago, Ill.

TRANSMISSION EQUIPMENT.
(Power.)
Jones & Laughlin Steel Co., Pittsburgh, Pa.

TRAPS.
(Steam.)
National Tube Co., Pittsburgh, Pa.

TROLLEYS.
Browning Co., Cleveland, O.
Chisholm & Moore Mfg. Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS.
(Foundry.)
Sterling Wheelbarrow Co., Milwaukee, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS.
(Motors.)
Kissel Motor Car Co., Hartford, Wis.

TRUCKS.
(Wire, Rod, Wire Mills.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

TUBES.
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

TUBES.
(Boiler.)
Allegheny Steel Co., Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
National Tube Co., Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Worth Bros. Co., Coatesville, Pa.

TUBING.
(Automobile.)
National Tube Co., Pittsburgh, Pa.

TUBING.
(Oil Well.)
La Belle Iron Works, Steubenville, O.
National Tube Co., Pittsburgh, Pa.
Youngstown Sh't & Tube Co., Youngstown, O.

TUBING.
(Seamless Steel.)
National Tube Co., Pittsburgh, Pa.

TUBING.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

TUMBLING BARRELS.
Pangborn Corporation, Hagerstown, Md.

TUMBLING MILLS.
Whiting Fdy. Equipment Co., Harvey, Ill.

TURBINES.
(Steam.)
General Electric Co., Schenectady, N. Y.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TURBO.
(Generators.)
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

TURNBUCKLES.
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Michigan Bolt & Nut Works, Detroit, Mich.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

TURNTABLES.
American Bridge Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.
Chase Foundry & Mfg. Co., Columbus, O.
Whiting Foundry Equipment Co., Harvey, Ill.

UNIONS.
(Pipe.)
Dart, E. M., Mfg. Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.

UNIVERSAL TOOL AND CUTTER.
Norton Grinding Co., Worcester, Mass.

VALVE LEATHERS.
Graton & Knight Mfg. Co., Worcester, Mass.

VALVES.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Scully Steel & Iron Co., Chicago, Ill.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

VALVES.
(Blast.)
Connersville Blower Co., The, Connersville, Ind.

VALVES.
(Gas and Air Reversing.)
Morgan Construction Co., Worcester, Mass.

VALVES.
(Relief.)
Connersville Blower Co., The, Connersville, Ind.

VALVES AND FITTINGS.
(Hydraulic.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Watson-Stillman Co., New York, N. Y.

VANADIUM.
American Vanadium Co., Pittsburgh, Pa.

VATS.
(Acid and Chemical.)
Hauser-Stander Tank Co., The, Cincinnati, O.

VENTILATING SYSTEMS.
Pangborn Corporation, Hagerstown, Md.

WAGON HARDWARE.
Oliver Iron & Steel Co., Pittsburgh, Pa.

WASHERS.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bettcher Mfg. Co., Cleveland, O.
Bourne-Fuller Co., The, Cleveland, O.
Milton Mfg. Co., Milton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Upson Nut Co., Cleveland, O.
Wrought Washer Mfg. Co., Milwaukee, Wis.

WASHERS.
(Leather.)
Graton & Knight Mfg. Co., The, Worcester, Mass.

WATER CINDER MILLS.
Whiting Foundry Equipment Co., Harvey, Ill.

WATERPROOFING CEMENT.
Texas Company, The, New York City.

WELDERS.
(Electric.)
Detroit Electric Welder Co., Detroit, Mich.
Long & Allstatter Co., Hamilton, O.
Thomson Elec. Welding Co., Lynn, Mass.
Toledo Electric Welder Co., Cincinnati, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDING.
(Custom.)
Oxweld Acetylene Co., Chicago, Ill.
Thomson Electric Welding Co., Lynn, Mass.

WELDING.
(Oxy-Acetylene Process.)
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

WELDING AND CUTTING EQUIPMENT.
Prest-O-Lite Co., The, Indianapolis, Ind.

WHEELBARROWS.
Sterling Wheelbarrow Co., Milwaukee, Wis.

WHEELS.
(Rope.)
Cooper, C. & G., Co., Mt. Vernon, O.
Mesta Machine Co., Pittsburgh, Pa.

WHEELS.
(Steel Car.)
American Steel Foundries, Chicago, Ill.
Carnegie Steel Co., Pittsburgh, Pa.

WHEELS.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

WIRE.
Cambria Steel Co., Philadelphia, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Youngstown Sh't & Tube Co., Youngstown, O.

WIRE.
(Barbed.)
Youngstown Sh't & Tube Co., Youngstown, O.

WIRE.
(Enameled Magnet.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Telephone and Telegraph.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Threaded.)
Progressive Mfg. Co., Torrington, Conn.

WIRE.
(Vanadium.)
American Vanadium Co., Pittsburgh, Pa.

WIRE MILLS.
(Complete Equipment.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

WIRE ROPE.
(Elevator.)
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE FITTINGS.
American Steel & Wire Co., Chicago, Ill.

WOODEN TANKS.
Hauser-Stander Tank Co., The, Cincinnati, O.

WRENCHES.
Ryerson, Jos., T., & Son, Chicago, Ill.

WRENCHES.
(Chain.)
Drop Forg'g Co. of N. Y., Jersey City, N. J.

WRENCHES.
(Pipe.)
Drop Forg'g Co. of N. Y., Jersey City, N. J.

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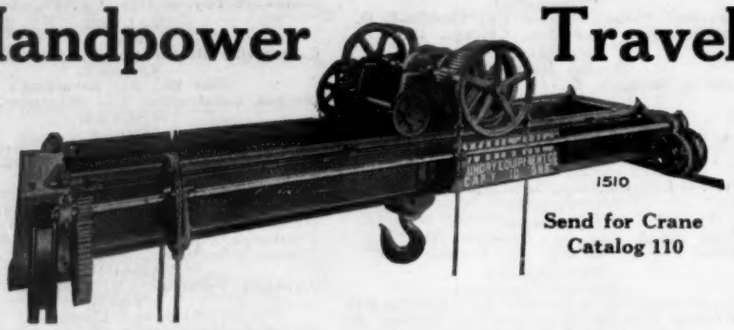

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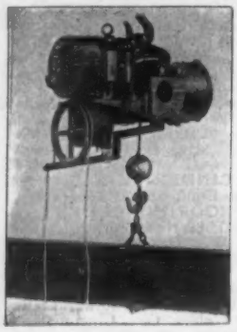

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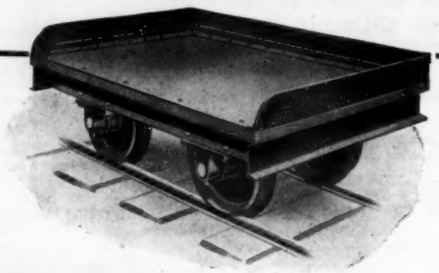

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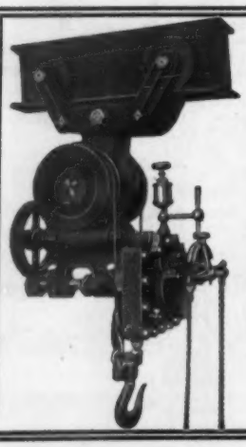

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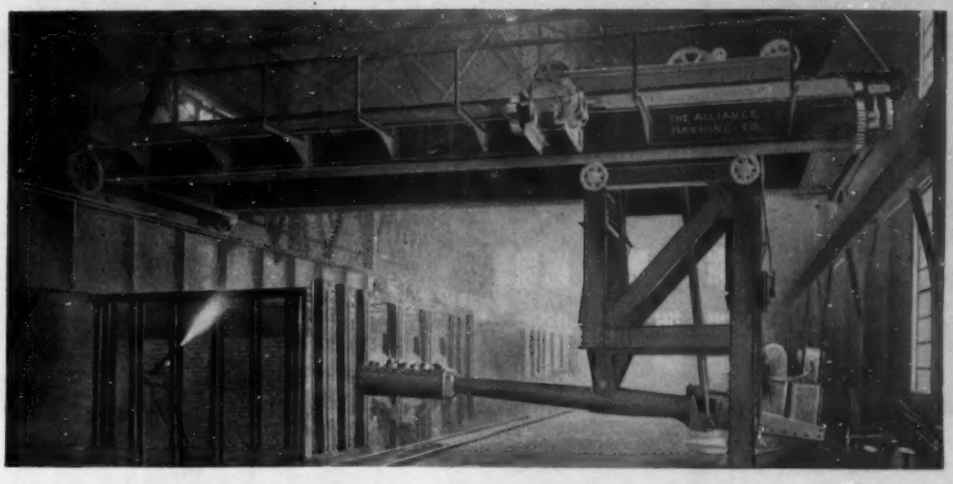

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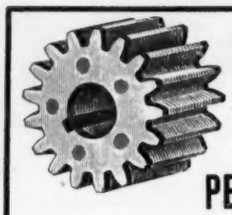

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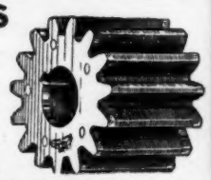

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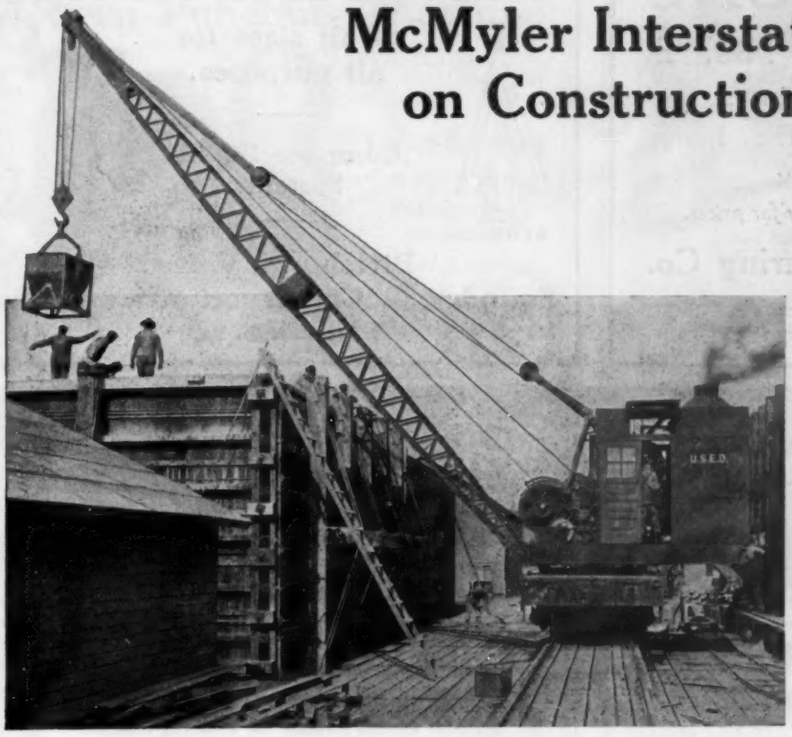

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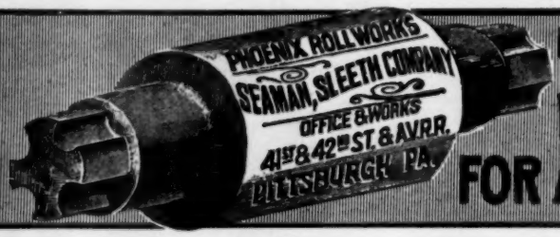

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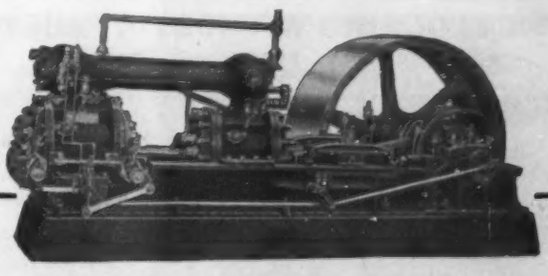

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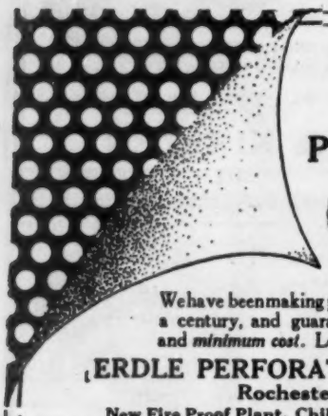

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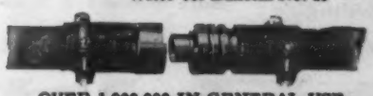
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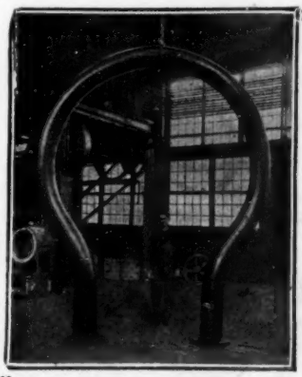
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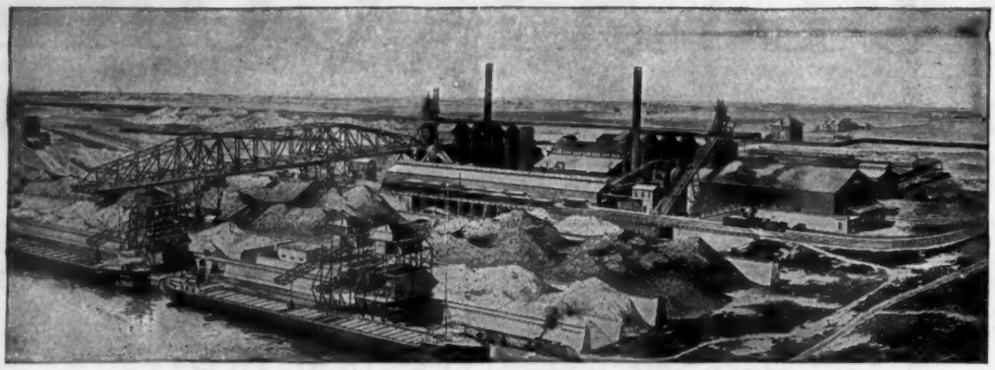

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Domestic

COKE
Furnace—Foundry
Domestic

GENERAL OFFICES: Brown-Marx Building, Birmingham, Alabama

BRANCH OFFICES:

Boston, Buffalo, Chicago, Cincinnati, Cleveland
Denver, Detroit, New Orleans, New York, Philadelphia
Pittsburgh, St. Louis, St. Paul

Pacific Coast Representatives: United States Steel Products Company, San Francisco, Seattle, Portland, Los Angeles

Export Representatives: United States Steel Products Company, New York City

Established 61 years

"THOMAS-VANADIUM" PIG IRON

Experience - Service Reputation - Quality

The Iron with the Long, Successful Record

Sixty Years the Leader

Over sixty years of faultless quality and service have given "THOMAS-VANADIUM" Pig Iron the reputation of being the highest grade and most desirable pig iron on the market.

"THOMAS-VANADIUM" has enabled many foundries to build up reputations by allowing them to produce highly satisfactory castings and to ship them on scheduled time.

Everywhere it has ever been used it has insured ***increased production, better quality, greater uniformity*** and ***decreased discount.***

"THOMAS-VANADIUM" is a pig iron that stands alone in its precious abundance of ***Strength*** and ***Toughness.***

It contains large quantities of Vanadium.

Therefore it has won and held its position at the top by pure ***merit.***

"THOMAS-VANADIUM" Pig Iron will help YOU!

We guarantee prompt shipment on short notice.

We will eliminate those delays and long distance freight charges to which you are accustomed.

THOMAS IRON CO HOKENDAUQUA, PA.

Quality since 1854

The Thomas Iron Co.

MANUFACTURERS OF
Foundry, Forge, Malleable, Basic
"THOMAS-VANADIUM" Pig Iron

General Sales Office: EASTON, PENN'A.

Philadelphia: 628 Stephen Girard Building
New York: 90 West Street Boston: 50 Congress Street

FOR EXPORT

PIG IRON : : COKE

Spiegeleisen **Fluor Spar**

Rogers, Brown & Co. representing more than 40 brands of Pig Iron and 32 brands of Coke offer to consumers abroad, unsurpassed opportunities to contract for their requirements. Inquiries solicited.

ROGERS, BROWN & CO.

New York Cincinnati Pittsburg, Chicago Philadelphia Buffalo Cleveland Boston St. Louis

E. N. Breitung & Co.
LAKE SUPERIOR
IRON ORES
Rockefeller Building, CLEVELAND, O.

Oglebay, Norton & Co.
LAKE SUPERIOR
IRON ORES
CLEVELAND, OHIO

The Columbus Iron & Steel Co.
BUCKEYE PIG IRON
COLUMBUS, OHIO

Pickands, Brown & Co.
PIG IRON
IRON ORE AND COKE
CHICAGO

Eaton, Rhodes & Co.
PIG IRON COKE
1503 Farmers Bank Bldg. PITTSBURGH, PA.
First National Building CINCINNATI, O.

Ferro Manganese Ferro Silicon **FRANK SAMUEL** Spiegeleisen Silico Spiegel
Iron Ore for Special Iron. Manganese and Chrome Ore
Pig Iron, Foundry Mill and Special Low Phosphorus
Howe & Samuel Special Low Phosphorus Melting Bar.
MAIN OFFICE Harrison Building Philadelphia
NEW YORK OFFICE 39 Cortlandt Street New York City
BOSTON OFFICE 10 Harris Avenue Boston, Mass.

McKeefrey & Co.
PIG IRON LIMESTONE
COAL AND CONNELLSVILLE COKE
LEETONIA, OHIO

CHARCOAL PIG IRON
Superior Charcoal Iron Co.
GRAND RAPIDS, MICH.

Mitchell-Diggins Iron Co.
CHARCOAL PIG IRON
CADILLAC, MICH.

The Tod-Stambaugh Co.
IRON ORES
206 Perry-Payne Building CLEVELAND, OHIO

"STRUTHERS"
BASIC PIG IRON
THE STRUTHERS FURNACE CO.
Furnace at Struthers, Ohio
Main Office, Citizens Bldg., CLEVELAND, OHIO

LOW PHOS. PIG IRON
BESSEMER PIG IRON—COKE
STEWART IRON COMPANY, LIMITED
CLEVELAND, OHIO
Works at SHARON and UNIONTOWN, PENNA.

W. P. SNYDER & COMPANY

Pittsburg, Pa.

PIG IRON, COKE, ORE

Products of

THE SHENANGO FURNACE COMPANY

DOUBLE DEAD BURNED DOLOMITE

MANUFACTURED BY

BASIC PRODUCTS COMPANY

ALLEN S. DAVISON COMPANY

Sales Managers

Oliver Building PITTSBURGH

THE "CLEARFIELD" FIRE BRICK

MANUFACTURED BY

THE CLEARFIELD FIRE BRICK CO.

Office and Works at CLEARFIELD, PA.

"Salina" "Etna"

"Lyon" "Yough"

Established 1845 Pittsburgh, Pa.

Manufacturers of

HIGH GRADE FIRE CLAY AND SILICA BRICK

HARBISON-WALKER REFRACTORIES CO.

MANUFACTURERS OF

High Grade Silica, Chrome, Magnesia and Fire Clay Brick

IMPORTERS OF

Chrome Ore and Spaeter Dead Burned Magnesite

PITTSBURGH, PA.

Jos. Soisson Fire Brick Co.

CONNELLSVILLE, PA.

The Stowe-Fuller Company

HIGHEST GRADE REFRACTORIES OF ALL KINDS

MANUFACTURERS of the Highest Grade Magnesite, Chrome, Silica and Fire Clay Brick

IMPORTERS of Chrome Ore and Grain Magnesite

5 MODERN PLANTS—250,000 DAILY CAPACITY

Plants located in Pennsylvania, Ohio and Kentucky

GENERAL OFFICES: CLEVELAND, OHIO

GLOBE

THE PIG IRON THAT MADE Jackson County SILVERIES "CELEBRATED"

All Grades 6 to 18% Silicon

UNION MINING CO.

MT. SAVAGE, MD.

Proprietors of the

Mt. Savage Fire Brick Works

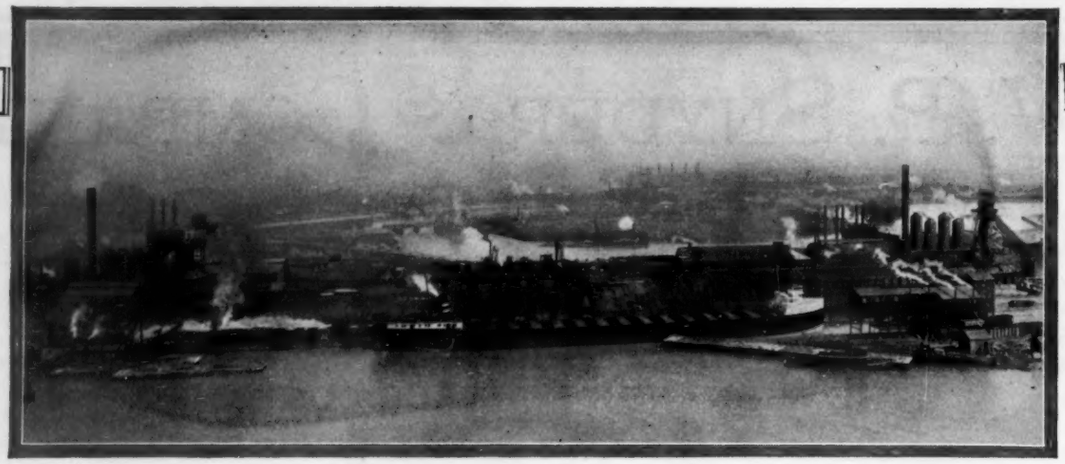
(SUCCESSFULLY OPERATED FOR 70 YEARS)

Manufacturers of

"Mount Savage" "M. S. A." "Refracto" "Carburetor"

Mt. Savage, Md.

1113-1117 Fidelity Bldg. Baltimore, Md. 405 Bank for Savings Bldg. Pittsburgh, Pa. 1 Broadway New York, N. Y.



THE HOME OF "BUFFALO" PIG IRON—THE BUFFALO-UNION FURNACE CO., BUFFALO, N. Y.

PIG IRON

"BUFFALO" BUFFALO, N. Y.
Foundry, soft and strong; Malleable

"CHERRY VALLEY" LEETONIA, OHIO
Foundry and Malleable

"CLAIRE" SHARPSVILLE, PA.
Basic and Bessemer

"DOVER" CANAL DOVER, OHIO
Basic and Malleable

"FANNIE" WEST MIDDLESEX, PA.
Bessemer

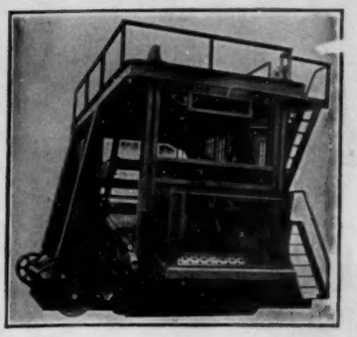
"VICTORIA" PORT COLBORNE, ONT.
Foundry, soft and strong; Malleable

"ZUG" DETROIT, MICH.
Foundry, soft and strong; Malleable; Basic

M. A. HANNA & Co.

Sales Agents **Cleveland**

M-A HANNA & Co.



COKE OVEN MACHINERY

To reduce operating costs, the modern coke oven plants must take advantage of every labor saving device adapted to its special conditions.

The loading machine shown receives the coke from the ovens, screens and delivers it into the cars for shipment.

The Conveyor is equipped with both vertical and horizontal movements.

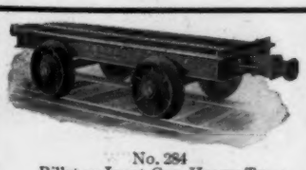
The Wellman-Seaver-Morgan Co.
CLEVELAND, OHIO
NEW YORK DENVER MEXICO CITY

The Largest **PIG IRON** Producer in the East

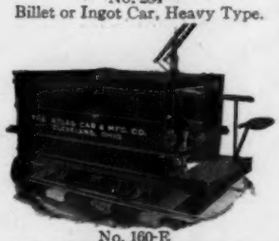
BASIC
BESSEMER
FOUNDRY
GREY FORGE
MALLEABLE
MILL IRONS

All Grades and Analyses

Bethlehem Steel Company
SOUTH BETHLEHEM, PENNSYLVANIA
BRANCH OFFICES:
PHILADELPHIA, Morris Building NEW YORK, Trinity Building BOSTON, Oliver Building
PITTSBURGH, First Natl. Bank Bldg. CLEVELAND, 1266 Ontario Street
DETROIT, Majestic Bldg. CHICAGO, Peoples Gas Bldg. SAN FRANCISCO, Crocker Bldg.



No. 284
Billet or Ingot Car, Heavy Type.



No. 160-E
Side Dump Gable Bottom Car
Electrically Operated.

Atlas High Efficiency STEEL AND COMPOSITE INDUSTRIAL Cars

Electric Locomotives, Storage Battery Trucks, *for every need*

Also rails, frogs, switches and other serviceable equipment

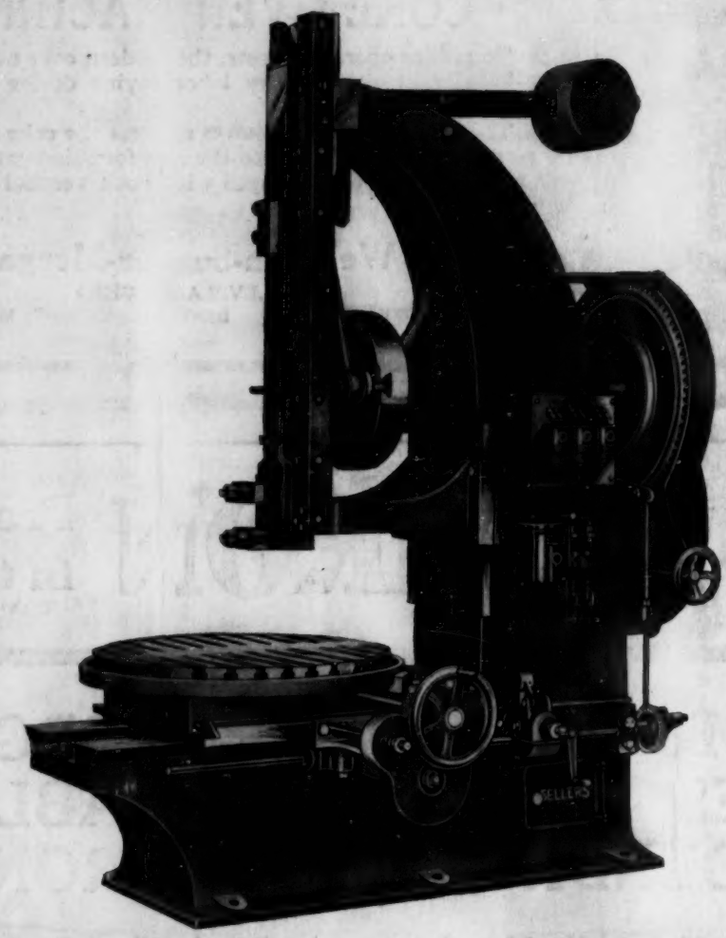
When you need a more efficient and economical method of transporting material about your plant—

SEND US YOUR INQUIRY.

The Atlas Car & Manufacturing Co.
1200 Marquette Road
Dept. E CLEVELAND, OHIO

No. 183
Four Hopper
Coal Larry Car.

Say you saw it in THE IRON TRADE REVIEW



A 60" slotter manufactured by William Sellers & Co., Philadelphia, Pa., and equipped with an E. C. & M. Automatic Machine Tool Controller that provides rapid, safe starting by throwing the handle of the operator's switch in one direction and dynamic braking in stopping by throwing the handle in the opposite direction.

The dynamic braking feature provides such accurate control that the tool can be instantly stopped at any point between the top of the stroke to where the stock is just touched by the point of the tool.

The application of E. C. & M. Automatic Machine Tool Controllers is not limited to any one or a few classes of machine tools. They are in daily operation on practically every kind of motor driven tool where delicacy of control and operating speed are requisite to the rapid production of first-class work.

Thousands of machine tool users have discarded their drum type and other rheostatic controllers in favor of E. C. & M. Automatic Machine Tool Controllers.

They have found that the increased production, savings in electrical and mechanical repairs, ease of operation and improved quality of product have more than compensated them for their investment.

In fact, E. C. & M. Automatic Machine Tool Controllers have gone far toward making it possible for some manufacturers to fill the big, rush orders which have been placed in the past few months.

Some of these manufacturers had seen the wisdom in this method of control and had equipped their machine tools. Others, who had hung back, lost some valuable time by having to install them while their plants were filled with rush work.

It will pay any user of motor driven machine tools to investigate E. C. & M. Automatic Machine Tool Controllers now and to install them wherever rapid, safe and accurate control is desirable.

E&M **THE ELECTRIC CONTROLLER & MFG. CO.** E&M

NEW YORK-50 CHURCH ST.
PITTSBURG-OLIVER BLDG.
BIRMINGHAM-BROWN-MARX BLDG.

CLEVELAND, OHIO.

CHICAGO-MONADNOCK BLK
DENVER-IDEAL BUILDING
TORONTO-TRADERS BANK BLDG.